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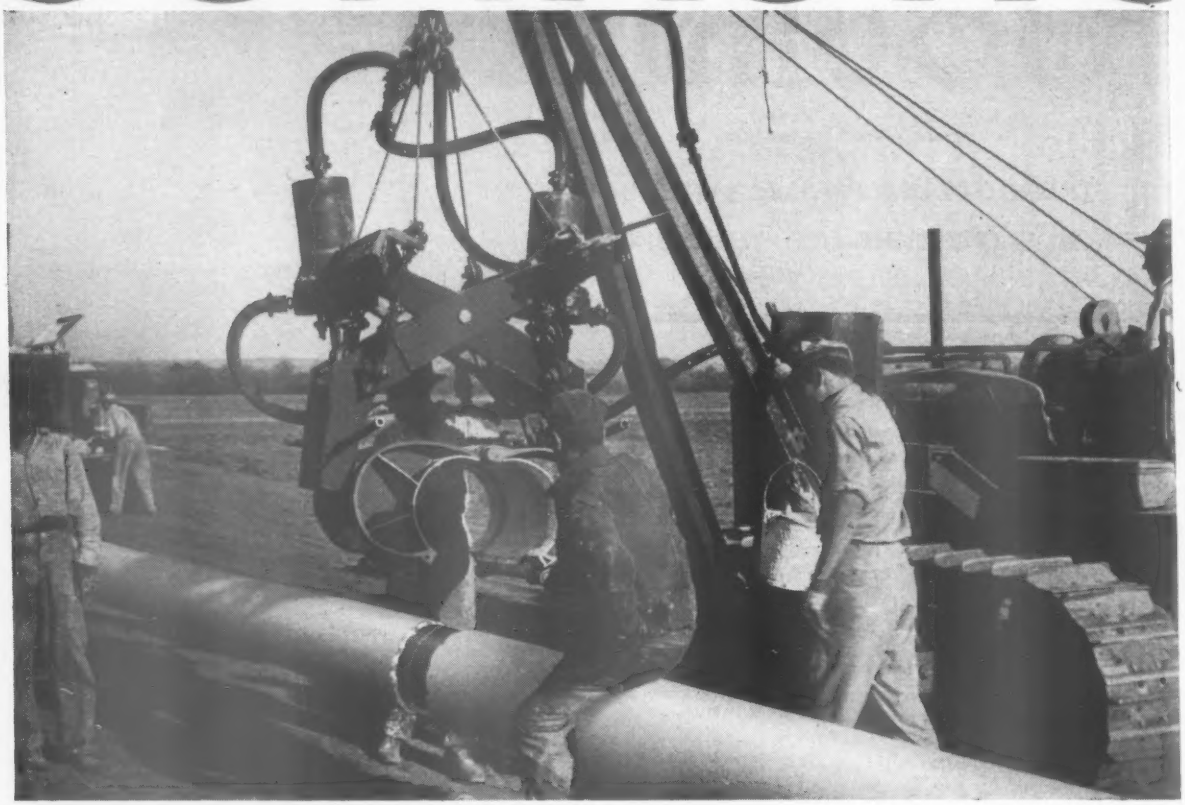

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Trends

Crude-Oil Production
By States—Page 336

CRUDE-OIL STOCKS 219,518,000 bbl. as of Dec. 15—up 1,163,000 bbl. One year ago 222,075,000 bbl.

GASOLINE STOCKS 89,043,000 bbl. as of Dec. 15—up 2,039,000 bbl. One year ago 82,996,000 bbl.

RESIDUAL FUEL-OIL STOCKS 42,962,000 bbl. as of Dec. 15—down 1,761,000 bbl. One year ago 59,118,000 bbl.

GAS OIL AND DISTILLATE STOCKS 40,968,000 bbl. as of Dec. 15—down 1,438,000 bbl. One year ago 41,759,000 bbl.

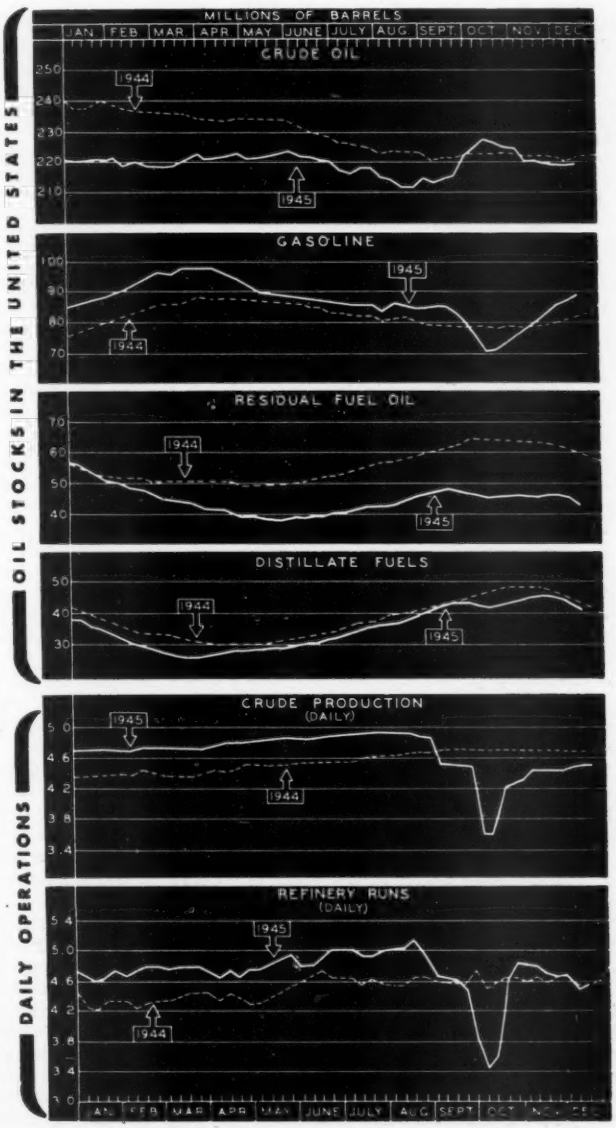
CRUDE-OIL PRODUCTION 4,488,000 bbl. as of Dec. 22—down 20,600 bbl. One year ago 4,721,550 bbl.

REFINERY RUNS 4,562,000 bbl. daily week ended Dec. 15—up 89,000 bbl. One year ago 4,576,000 bbl.

GEOLOGISTS and others who have the responsibility of finding additional petroleum reserves in this country are in agreement that based on the discoveries of the past year and those in prospect, more and more attention will be given to the deeper producing horizons. The better steels and improved machinery are factors in this trend and there is no question that the industry now has the tools to carry on the deeper operations. But those in touch with conditions also emphasize the fact that the discovery and the technical ability to drill and produce are not the complete answer to this problem of securing commercial production from these deeper pays.

A NEW approach in the matter of well spacing is being emphasized by managements and engineers, a need which has been explained in operating articles appearing in this publication in recent months. Operators point out that while unitization is desirable in all types of production operations it is practically mandatory in the development of the deeper pays. Basing their conclusions on what has been accomplished so far operators have outlined programs which call for unitization, wide spacing, and pressure-maintenance programs. Examples of what can be done in shallower pays are apparent in the cases of Paloma, California; Elk Basin in Montana and Wyoming; Conroe and Van in Texas, and Erath in Louisiana.

THOSE who have made studies of what needs to be done stress the education of farmer-lessors, royalty owners, small and inexperienced operators, and most importantly the state regulatory bodies. These people have the final say of what can be done in many cases. It is felt that their attitude will be one of cooperation when they fully understand the basic operating principles involved. Because the facts have not been fully appreciated, for every successfully project placed in operation other dozens have died on the vine. Operators are urging that this program, particularly in the case of deep pays, be given special consideration in the year ahead. Programs have been outlined in which individual wells cost in excess of $250,000 where it appears that one well to 80 or 160 acres is feasible from the standpoint of economical recovery. The engineering reports on which these projects are based reveal that plans for an entire area can be outlined after the completion of the first well.



Wage Panel Recesses, With Strike Settlements Likely

by Henry D. Ralph

WASHINGTON.—The oil-refinery wage panel recessed until January 7 after a brief meeting on December 21, with the prospect that voluntary collective bargaining would settle the strikes at all refineries which had been taken under Navy control by order of the President.

Representatives of both the Oil Workers International Union and the refineries taken over by the Government expressed belief that wage settlements would be made soon and that all plants would be released from Navy supervision so that there would be no further need for the fact-finding panel.

Panel Chairman Frank P. Graham joined in the hope that his group would have nothing further to do, but warned that any companies failing to settle their labor dispute by January 7 were expected to have representatives present for further hearings on that date.

No Facts Ascertained

Thus the fact-finding panel prepared to fold up without finding a single fact or taking a word of evidence on the merits of the controversy which led to a cripping strike and government seizure of some 50 refinery and pipe-line facilities, and settlement was back to the basis that existed before the Government first interceded—collective bargaining on a plant-by-plant basis with local unions. The union apparently had abandoned for all practical purposes its insistence on a uniform nationwide settlement and on wage increases geared to the companies' ability to pay.

This action came coincidentally with a union victory in the form of a White House pronouncement that fact-finding panels may base wage awards on the employer's ability to pay and to that end may examine company profits and prices.

This point occupied chief attention of the oil-wage panel at its opening sessions December 17 and 18. The union presented two formal "propositions" on which it asked rulings as a basis for further proceedings. The questions involved interpretation of executive orders of the president and regulations of the director of economic stabilization, and since over-all government policy was concerned the panel announced it could not make a decision until December 21 following consultation with appropriate officials.

The union's questions dealt with the power of the panel to recommend wage increases which might affect price ceilings, and so indirectly raised the question of company profits. Since the same questions were likely to be raised in other wage-dispute fact-finding proceedings, President Truman issued a policy statement December 20, and the following day Secretary of Labor L. B. Schwellenbach published detailed rules of procedure and policy for all such panels.

These statements were formally presented at the oil hearing, but at the same time the panel declared it would adhere to its own rules of procedure previously announced and issued its own answers to the union's questions. The answers were in line with the general policy statements, but were specifically directed to the points raised by the oil union.

The policy statements were generally considered to be a victory for the position of organized labor in many current wage disputes, but the oil-panel rulings did not go as far as the union had hoped, for the panel adhered to its position that it would not inquire into prices and profits unless the companies should plead inability to pay any wage increase the panel might recommend.

Increase a WSB Matter

The panel ruled that it does have the right to recommend a wage increase which might be used as the basis for a request for higher price ceilings, but that the question of a price increase would have to be decided by the Wage Stabilization Board and Office of Price Administration.

The union also asked if the panel could recommend a wage increase for reasons other than those listed in an executive order—the only one applicable to the oil controversy being to bring hourly wage rates in line with increases in the cost of living. The panel ruled that it might ask the stabilization director to approve an increase on some other grounds, but it would do so only on the most compelling reasons. To judge from the brief previously filed by the union, it appeared that the union had hoped to open the way for justifying a substantial wage increase on the grounds of general prosperity or some other basis than the arithmetical ratio of wage rates and living costs compared with 1941 conditions.

To this extent, at least, the ruling of the oil panel was a defeat for the union and was considerably narrower than the policies laid down for future fact-finding panels. This may have had some bearing on the willingness of the union representative to recess the hearings in the hope that voluntary settlements could be reached.

It was apparent, however, when the panel resumed its session Friday after the 2-day recess that there was a general disposition to seek settlement without further government intercession.

A telegram from Shell Oil Co., Inc. was read into the record explaining that company's failure to appear because negotiations had been resumed on a plant-by-plant basis with the local unions concerned and the company had reason to believe that a settlement would be reached soon.

Sohio Resumes Bargaining

William A. McAfee, general counsel of Standard Oil Co. (Ohio), moved for a recess to January 7, explaining that his company had resumed collective bargaining and was hopeful of a settlement within a short time. He added that he had unofficial information that other companies under Navy seizure were doing the same, so it would be a waste of time to discuss academic matters before the panel if a settlement is to be made without the panel's aid.

Richard H. Lowe, of Socony-Vacuum Oil Co., Inc. added that he understood his company was already negotiating with the union.

P. G. Wharton, vice president of Atlantic Refining Co., asked for a recess to study the panel's rulings. Asked by Chairman Graham about further collective bargaining, Wharton declined to make any statement, but on further pressing he said his company always had been ready to settle wage disputes by collective bargaining and he knew of no reason why it should not do so now.

This statement was received with acclaim by counsel for the union.

E. Carl Mattern, vice president of the Oil Workers International Union, and Lindsay P. Walden, its general counsel, told the panel that from the start the union had taken the position that the controversy could and should be settled by collective bargaining. They confirmed that many of their local unions were already negotiating with various companies and said they welcomed this opportunity for resumption of the procedure, though they desired assurance that all companies would resume negotiations.

FEA Recommends Elimination of German Synthetic-Fuel Industry

WASHINGTON. — Complete elimination of the synthetic liquid-fuels industry of Germany and strict limitation of petroleum imports is recommended by Foreign Economic Administration in an exhaustive report presented to the Senate military affairs committee last week.

The report presents a complete program for German economic and industrial disarmament, and while it is not yet official government policy it represents the views of many high officials as to the best ways of carrying out the general policy statements of the Yalta Declaration, the Berlin Protocol, and other announcements of the White House and the State Department.

The general plan is not to make Germany a purely agricultural state but to strip it of all heavy industries which might be used for building up a war potential or to secure economic dominance of her neighbors, while leaving sufficient industrial capacity to maintain a healthy internal economy.

Included are recommendations for prohibiting all German scientific research which might have a wartime value, strict control of German imports and exports, supervision of German investments and other activities in foreign countries, and elimination of cartels and all varieties of connections between corporations in Germany and in other countries.

All synthetic liquid-fuel installations in Germany should be removed or destroyed immediately, it is recommended, regardless of any value they might have in maintaining the internal economy or reparations payments during the next year or two. The same recommendation is made as to synthetic-rubber plants and other industrial facilities scheduled for ultimate elimination. Whether individual plants and laboratories should be destroyed or removed to other countries is a complicated question tied up with reparations payments, a subject discussed in detail in one section of the huge report.

In addition to complete and permanent elimination of the German synthetic oil industry, the report recommends that for at least 10 years the Allies limit the German oil-refining industry to a capacity of 700,000 to 750,000 tons per year, or sufficient to handle the estimated indigenous crude production of Germany. This contemplates removal from Germany of refining equipment with an estimated capacity of 2,350,000 tons per year.

The coal-tar-distillation industry would be licensed, and its capacity limited to the amount needed to distill tar from permitted coal-tar plants under the steel program. The rubber industry would be limited to plants to fabricate the 30,000 tons per year of natural crude rubber which Germany would be allowed to import, with no synthetic-rubber industry whatsoever. The chemical industry likewise would be strictly controlled, with some important basic chemical industries completely eliminated.

Maximum utilization of German natural crude petroleum is deliberately recommended by FEA, first to reduce the need for imports at a time when foreign exchange will be at a premium, and second to deplete Germany's limited reserves and make the nation so dependent on imported liquid fuels that stockpiling and preparation for war would be impossible.

German Import Needs

Allowing for internal production of 750,000 tons of crude petroleum per year, FEA estimates that Germany would need to import a minimum of 1,750,000 metric tons of petroleum and refined products. Most of these imports would be in the form of refined products, since the recommendations contemplate that refining facilities in Germany will be limited to those necessary to process indigenous production of crude plus a modest operating reserve and plus requirements for producing minimum supplies of petroleum specialties not readily importable.

Imports of required petroleum products would be permitted, under control and supervision, but FEA recommends that imports should be kept sufficiently low to prevent stockpiling for war purposes, and in addition small imports of crude or intermediates may be allowed but these should not aggregate a substantial percentage of the entire petroleum requirements.

As justification for this proposed treatment of the German petroleum industry, the FEA report says:

"The program of eliminating synthetic - petroleum - production facilities and of exploiting the limited supplies of natural crudes is a double check on the resurgence of excessive capacity in the German liquid fuels industry. The reconstruction of a synthetic-oil industry, if disarmament control should ever break down, would take considerable time and require scarce raw materials and high technical skill, thus prolonging the period necessary for German rearmament. During the intervening period, German indigenous crudes would be further depleted since imports of petroleum crudes and products will be greatly restricted. There will also no longer be available in Germany excess capacity for processing imported crudes or synthetic products, should the Germans attempt to gain access to foreign crudes."

These recommendations are based primarily on a report of a technical industrial disarmament committee on the German oil industry, one of about 30 such committees whose reports heretofore have been secret. This committee was composed of Ralph K. Davies, deputy petroleum administrator, as chairman, Rear Adm. A. F. Carter of the Army-Navy Petroleum Board, Brig. Gen. W. E. R. Covell of the Office of Quartermaster General, Brig. Gen. H. L. Peckham of the War Department Fuels and Lubricants Division; Charles P. Rayner, petroleum adviser to the Department of State, and Bruce K. Brown, E. DeGolyer, Joseph E. Pogue, and George H. Taber, all serving as special consultants to FEA. This committee made the following recommendations:

"1. The development of the synthetic-oil industry was an essential part of Germany's autarchic program, which was an important phase of Germany's preparation for war. Except for the armament industry itself, probably no better example of a war industry can be found. It is therefore recommended that all Borgius hydrogenation and Fischer-Tropsch synthesis complexes be eliminated, either by destruction or transfer, and that the erection of new plants in Germany to produce oil synthetically from coal or other carboniferous materials by these or similar methods be forbidden.

"2. In view of the severe damage inflicted on the synthetic-oil industry and the serious coal shortage in Europe, it is recommended that no attempt be made to repair the plants even for an interim period, and that the dismantling of the industry be undertaken in the near future.

"3. There appears to be some justification for a limited amount of imported crude oil and/or semifinished products. Therefore it is recommended import of crude and semifinished products be controlled and limited in quantity and quality.

"4. As it is entirely possible that important new crude-oil discoveries may be made in Germany, it appears desirable to introduce some form of control over the develop-

ment of domestic crude production and its refining.

"5. Unless alcohol becomes a strategic fuel, it is recommended that no attempt be made to control or restrict its production.

"6. It is recommended that no attempt be made to control German shale-oil production unless it is found that it is being produced in quantities sufficiently large to add substantially to Germany's war potential.

"7. It is recommended that no restrictions on the production and consumption of solid substitute fuels be introduced unless they are developed sufficiently by German technologists so as to be useable as motor fuel for military equipment."

In commenting on this the FEA report mentioned the fact that the TIDC did not specifically recommend maximum exploitation of German natural crudes, adding:

"It seems desirable to state this recommendation specifically in order to deplete German natural resources of crude oil. Otherwise, if sufficient foreign exchange were available, Germany could import her entire requirements of crude oil while conserving her own deposits for use during a future war."

Abrams New Jersey Board Chairman

AFTER spending his entire 49-year business career with Standard Oil Co. (New Jersey) and its affiliates, Ralph W. Gallagher will retire December 31 as chairman of the board of directors and chairman of the executive committee. His resignation was announced by the board "with the deepest regret."

Frank W. Abrams, vice president and director, has been elected to succeed Gallagher as chairman of the board. Eugene Holman, president, will take over the position of chairman of the executive committee while continuing as chief executive.

Other changes in the executive personnel include the election of J. R. Suman, a vice president and director, to become a member of the executive committee; R. T. Haslam, a director since 1942, to become a vice president, and S. P. Coleman, head of the economic and coordination department, to become a director.

Gallagher headed Standard Oil Co. (N.J.) during World War 2 when the industrial capacity of the company and its affiliates became a major factor in supplying petroleum products to the United States and her allies.

Going to work at 16 as an oiler in a pumping station, he rose to one of the world's most responsible industrial positions. Elected a director of Jersey Standard in 1933, he became vice president in 1937 and chairman of the board in 1942.

As a director and later as chairman, Gallagher gave major attention to financial programs and to programs encouraging the development, advancement and security of employes.

Gallagher was born in Salamanca, N. Y., in 1881. He left high school because of illness of his father to take his first job with New York Transit at Olean, N. Y. His duties as an oiler included sweeping out the pumping station every day. At night he studied engineering.

In 1900, at the age of 19, he went with East Ohio Gas Co., a Jersey Standard subsidiary, in Akron. Two years later when gas lines were started to Cleveland, he was made assistant superintendent. In 1906 he took over direction of all pipe-line work and became superintendent of all distributing plants outside of Cleveland. In 1908 he moved to Cleveland to supervise all of the East Ohio Gas Co.'s properties. In 1926 he was elected president of East Ohio.

Leading Oil Figure

Abrams was born in Rockville Center, L. I., in 1889 and has been a leading figure in the development of oil refining for 33 years. His first job was as a draftsman with the Eagle Works of the company at Jersey City in 1912 after being graduated from Syracuse University. In 1914 he was named assistant superintendent of the Eagle Works and 3 years later was appointed superintendent. He was subsequently made manager of the Eagle Works and of the company's Parkersburg, W. Va., refinery.

Abrams was named head of all refining operations of the company in the New Jersey area in 1926, and was elected president of the principal domestic refining and marketing affiliate of Jersey Standard in 1933. He was elected to Jersey Standard's board in 1940 and was made a vice president in 1944.

Haslam, who becomes a vice president, has been with the company since 1927, and has served as director of research and later as general sales manager prior to being named a director in 1942.

Coleman, the newly elected director, has been associated with the company in research, refining, and economics for more than 25 years.

F. W. ABRAMS

RALPH W. GALLAGHER

R. T. HASLAM

THIS WEEK

LABOR— Fact-finding wage panel likely to fold up without finding a fact or taking a word of testimony. . . . Recesses till January 7 on prospect that voluntary agreements will be reached between union and the half-hundred strike-bound refineries seized by Navy last October on presidential order. . . . Union apparently has abandoned its demand for nation-wide settlement and for wage increases based on ability to pay. . . . Wins important point, however, in White House ukase that fact-finding panels may base wage awards on ability to pay and may have access to employers' records to ascertain profits. . . . ¶Sinclair's settlement by granting 18 per cent increase likely to provide basis for resolving other disputes. . . . ¶Meantime, oil industry is watching General Motors negotiations closely with view of obtaining further clues to Government's attitude toward fact-finding plan. . . .

TRANSPORTATION— A.P.I. asks ICC for 1-year extension of order placing private carriers under current regulations governing transportation of inflammable liquids by common and contract carriers. . . . Affects gasoline especially. . . . A.P.I. contends that though order was "quite properly" designed to protect carriers who might otherwise be ignorant of dangerous character of shipment, such precautions are unnecessary when shipments are made by oil industry itself. . . . ¶Chairman Litchfield, of Goodyear, predicts "ample natural rubber in world supply pool by end of 1946." . . . Spent month in Europe on rubber mission. . . . ¶Lead allocations for passenger-car batteries and for production of tetraethyl for gasoline will be reduced in first quarter of 1946. . . . CPA says 4,200,000 of the batteries can be produced from the revised quotas, compared with 3,200,000 in similar quarter of 1945. . . .

POSTWAR— FPC emphasizes that action will be taken against any interstate natural-gas company which violates law requiring that prior authoriy be obained for construction of new facilities. . . . Wartime practice of issuing temporary certificates to be followed no longer. . . . Materials unobtainable during war now available. . . . ¶Some $6,000,000 worth of marine diesel and gasoline engine equipment, parts, and maintenance tools, declared surplus by armed services, now on sale. . . . ¶PIWC shelves proposals for permanent national oil agency. . . . Liquidating its affairs, with no definite prospects for a continuing organization, but committee appointed to study problem. . . .

PRODUCTION—Nation's crude output down 20,600 bbl. daily, with total daily average 4,488,100. . . . California leads in recession, with dip of 11,600 bbl. . . . Kansas off 4,100 and Michigan 4,200. . . . ¶Completions for week total 538, up 9. . . . ¶Unexpectedly vigorous demand for crude simplifying reconversion problems. . . . ¶Bureau of Mines revises estimated market demand for Texas crude in January upward, from 1,775,000 bbl. to 1,950,000. . . . ¶Geological Survey announces several oil-bearing and associated formations in northwestern Colorado and northeastern Utah are prospectively valuable oil and gas sources on many untested anticlines. . . .

SCRAMBLE—Removal of gasoline rationing sets off scramble for premium fuels, and octane race is on. . . . Demand liveliest in coastal areas, where sales of premium fuels range up to 90 per cent of total. . . . Bulging pocketbooks of war workers and desire to buy "the best" are important factors in brisk market. . . . Situation believed to be passing one. . . .

Oil-company representatives at last week's meeting of the oil-refinery wage panel are shown here discussing the case. The men are William A. McAfee, general counsel for Standard Oil Co. (Ohio); Richard H. Lowe, counsel for Socony-Vacuum Oil Co., Inc., and P. G. Wharton, vice president, Atlantic Refining Co. The panel recessed until January 7, with a good prospect that voluntary collective bargaining would bring about a settlement of the dispute. *(See story on page 154)*

Harris & Ewing

Octane Race Under Way On East, West, and Gulf Coasts

by Arch L. Foster

THE "octane race" is already accelerating in the coastal areas of this country, a careful study of the situation reveals. Primed by the release of refining facilities formerly used to produce aviation and military fuels, and emphasized by the low levels of motor gasolines in retail distributors' tanks, the pressure following the removal of gasoline rationing has had its effect in an unprecedentedly strong fashion. The result has been to create a demand for high performance in motor fuels greater than has been the case at any time in the industry's history.

Another factor which has helped to hurry this situation in at least three areas of the country is that of the customer's reaction against the generally very poor grades of wartime fuel. Refiners say simply that the motorist is tired of hearing his car hammer on the poor gasoline obtained when he released his priceless coupons for his 2 gal. per stamp; he is not only demanding, but buying the best grade of fuel he can find.

A careful survey of the situation shows that on the East Coast the amount of premium motor fuel being sold in recent months ranges from 35-40 per cent of the total motor-fuel sales, to more than 75 per cent. One filling station in a metropolitan area is reported to have sold not a gallon of housebrand or third-grade gasoline for weeks. While this situation is of great interest and a major return to the marketers, it also brings complications in manufacture and distribution.

On the West Coast reports say that the percentage of premium-grade sales is running even higher, one source reporting that in metropolitan areas 80-90 per cent of total sales is premium motor fuel. The West Coast has always moved ahead of the rest of the country in antiknock ratings chiefly because of the properties of Pacific Coast crudes and gasolines therefrom. Also it is reported that the Gulf Coast, with little geographic elevation but with concentrated automobile population, buying power, and refining capacity for making octane numbers, is following closely on the heels of the East Coast sales. Without exception refiner-marketers blame this on the two reasons: still plenty of war-earned money in customers' pockets, and the wish to buy the "best" which has been denied them so long.

Coincidental with this upping of premium sales a rapid rise in octane ratings of currently marketed fuels has occurred, especially over three of the four general sections of the country. One company reports distributing 75-76 octane number (Motor Method) in the East and Gulf Coast, and up to 80 on the West Coast. At least one company is shipping 78-80 (M.M.) octane number housebrand fuel on the East Coast, with premium grade (Ethyl) at 83-84 and making up one-half to three-fourths of the trade. The recently announced Sun's Dynafuel, although the company does not talk octane numbers but road performance, is reported to rate 77-78, M.M., and 86-87 by the Research Method. The Research Method now shows results closest to the road octane numbers on engines now on the road. Some confusion is resulting from using numbers obtained by different methods; Research octane numbers on most fuels will be 5 to 10 higher than those obtained by the Motor Method on the same fuel. Most companies are striving to maintain 85-87 Research octane number for their housebrand fuels; those with catalytic cracking capacity in an area can maintain this level without difficulty.

Mid-Continent Not in Race

With the three coastal areas apparently joined in the octane race, the great central body of the country has not begun yet to raise ratings in any serious degree. One active independent is making 74-75 M.M. rating fuel for housebrand; for premium, 78. This refiner with good thermal cracking, reforming, and polymerization capacity says he can go to 77-78 M.M. housebrand, 82-83 premium without serious damage to yields or costs. If the levels go to 80 for housebrand, and 84-87 for premium his facilities cannot meet the competition. Another refiner with several plants is putting out a premium fuel with 10 per cent evaporated at 118°-120° F.; 50 per cent at 190°-200° F., and a Motor Method rating of 77-78, but expects to boost the knock rating value in the near future in East and West, and probably in the Gulf Coast. This refiner says all marketers will be shipping 80-octane-number housebrand fuel in the North and East within the next 60 days, and that all coastal areas, and possibly the entire country, will be at that level before hot weather.

The great central part of the country from the West Coastal boundary to somewhere east of the Mississippi, even to the Appalachians, has not entered the race seriously yet, it appears. While selling 35-50 per cent premium, with that value likely to go higher soon, average ranges of 78-80 premium, 74-75 housebrand, M.M. are holding at present. Great Lakes Pipeline Co. is shipping 80 M.M. Ethyl, it is reported. Reports say Ethyl Corp. will set 80 M.M. as the minimum for Ethyl gasoline about January 1, with a customary interim of 90 days. With this status, and with Ethyl sales ranging so high, most refiners in the so-called Districts 2 and 3 may find it difficult to keep their regular fuel up to 75 or above without cutting severely into yields and profits. Crude supply may become too limited to furnish serious yield reductions.

Most of these refiners have no catalytic cracking processes, 17 units being confined to Ashland, Standards of Indiana and Ohio, Shell, Sinclair in Wyoming, Socony-Vacuum, Continental, Root, Utah, Phillips and the small Frontier plant in Wyoming. Associated at Duncan, Okla., is shut down, as is the Cooperative at Coffeyville. In this area only two companies have catalytic capacity sufficient to enable them to start or maintain a satisfactory octane race. Both those companies have consistent records of opposition to blind races and of following rather than leading them. If the race reaches the 80-87 range for the two grades, many refiners cannot reach these levels at any price, and many can do so only at serious cost in yield and total returns. The midget catalytic cracker planned for Leonard Refineries in Michigan undoubtedly is built as a "guinea pig" to "iron out the bugs" in the small catalytic unit. A midget Fluid unit is designed but so far as known none are under contract or construction yet. Until catalytic cracking is generally operating, mid-U.S. refiners cannot go very far in octane racing, up to say 77 M.M. housebrand, 82-83 premium at most, according to the majority of refining executives. This situation is not true of the coastal areas mentioned, and the race there is not easily predictable as to levels which will be reached.

As to actual requirements of the cars on the road for antiknock ratings of 80 or above, with exception of special engines refiners and automotive men say they don't need it, and cannot use it efficiently. Housebrand fuels are quite satisfactory, generally.

Olefins Used to Make Huge Chemical Tonnage in 1945, A.I.Ch.E. Meeting Told

by Arch L. Foster

CHICAGO. — Chemicals from unsaturated hydrocarbons, alkylation of isoparaffins commercially, hydrogen - manufacturing methods, the styrene synthesis, liquid-phase isomerization of normal paraffins, electronics applied to instrumentation, heat transfer, fractionation, and distillation problems, silicones, and synthetic rubber are a few of the subjects discussed by America's leading chemical engineers before the Institute of Chemical Engineers which met here December 17-19. Turning their attention from war to peacetime products and processes, nearly 1,500 of these scientists talked at great length on the subjects to which they are giving intensive study and experiment.

Presentation of the size and extent of the organic-chemicals industry as made from petroleum and natural-gas hydrocarbons was one of the outstanding lights of the programs. Practically half a million tons of olefins, of which 275,000 tons is ethylene and 220,000 tons is propylene, will be used in 1945 to produce an imposing list of chemicals, said A. W. Pratt and N. L. Foskett, Stone & Webster Corp. Glycols, plastics, solvents, and alcohols including large amounts of glycerine are included in this list. Production of synthetic rubber will consume another half million tons of butadiene, ethylene, and benzene. Fractionation of these very low-boiling materials is an important part of their processing in which rapid strides have been made using superfractionation, azeotropic distillation, and other methods.

One of the major problems in handling anhydrous aluminum chloride as a catalyst in isomerizing hydrocarbons has been solved by making a mixed catalyst of about 8 per cent $AlCl_3$, 92 per cent $SbCl_3$ (antimony trichloride) which is liquid at operating temperatures. This process was described by S. H. McAllister who authored the paper with W. E. Ross, H. E. Randlett, and G. J. Carlson of Shell Development Co. With a catalyst containing 9-10 per cent $AlCl_3$, at 176°-194° F. temperature and 5 per cent hydrochloric acid in the feed as promoter, normal butane yields 54.5 per cent isobutane per pass. Operating on normal pentane with 3 per cent $AlCl_3$ at 176°-212° F. and 5 per cent HCl in the feed, the conversion is 60.5 per cent of isopentanes. Recyling the unchanged feed gives 97 per cent total yield of isoparaffins. Liquid catalyst flows downward through a packed tower; the feed is dried, the HCl is added and the mixture passes upward in countercurrent flow to the catalyst. The outgoing product is caustic scrubbed or soda washed and fractionated. Octane number of a primarily hexane stock is raised from 64-69 to 77-79 by such treatment; isomerization of hexanes, however, has not been fully solved yet, the author said. Four of these plants are operating in the United States, one is building in Mexico, and one is authorized in the Netherlands West Indies.

HF Units at End of War

HF alkylation units to the number of 27 were operating in the United States at the end of the war, E. M. Skinner, Socony-Vacuum Oil Co., Inc., stated in presenting that process. In a unit designed for 630 bbl. per day of product as much as 1,200 bbl. have been produced in a single day. For 2 years one unit has been on stream 89 per cent of the time. The octane number of the product decreases with increase of reaction temperature, Skinner said; octane number rises with the concentration of HF in the reaction mixture, and yield decreases with the percentage of butene-1 in the feed. The average yield of alkylate has been 163 weight per cent of the butene treated, Skinner claimed. Catalyst, anhydrous hydrofluoric acid, loss has averaged 0.85 lb. per bbl. of alkylate. For three plants of different sizes, the following total operating costs have been found:

Plant, B/D alkylate	490	560	1540
Cost, $/bbl. alkylate	$1.47	1.36	1.78

The octane - rating change with change in reaction temperature is greater than this author showed, opined P. M. Arnold, Phillips Petroleum Co. technologist in discussing the paper. Arnold stated that Phillips includes 10 per cent of lime in the bauxite to reduce loss of fluorine as silicon tetrafluoride, SiF_4. Phillips has carried out extensive experimental work in this process.

Silicones will become more and more important industrially and commercially, in the opinion of M. G. Fontana of E. I. duPont de Nemours Co. Major priority in the electrical field during war prevented their use in other fields, to which use of silicones is spreading rapidly, he said. Silicone greases for plug valves, etc., can be obtained from the Merco-Nordstrom Co. These products, made by combining organic radicals with oxides of silicon to form chain compounds of the form of

$$\text{Si-O-Si-O-Si-O-Si--},$$
$$\text{2R}\quad\text{2R}'\quad\text{2R}''\quad\text{2R}$$

etc., where R represents either the same or different organic groups. are used to coat metal and other containers, must be cured on like raw rubber and difficulty is experienced, probably in coating large-tank inner surfaces, since it must be cured at about 200° C. (392° F.) As lubricants silicones have five or more times the life of the best hydrocarbon oils, when used up to about 175° C. (347° F.) The highest practicable operating temperature is about 200° C. if continued for a great length of time.

The papers on important engineering subjects given are too numerous and lengthly to cover here. The Dow process for styrene production from ethylene and benzene, alkylating first with $AlCl_3$ as catalyst, then dehydrogenating the ethyl benzene with a metal oxide catalyst in presence of steam, was presented. Purification of butadiene with cuprous copper chloride salt was outlined in detail by C. E. Morrell and others from Standard Oil Development Co. Design of catalyst reactors, illustrating the dehydrogenating butane, and giving important findings, was discussed by R. H. Dodd and K. M. Watson, University of Wisconsin.

J. G. Vail Elected President Of Chemical Engineers

CHICAGO.—James G. Vail, vice president of Philadelphia Quartz Co., was elected president of the American Institute of Chemical Engineers, and announcement was made at the Institute's 38th Annual meeting here December 17. The newly elected vice president is C. M. A. Stine, vice president of E. I. duPont de Nemours & Co. Four new directors are: Joseph K. Roberts, research director, Standard Oil Co. (Indiana); C. G. Kirkbride, chemical engineering professor, Texas A. & M. College; John H. Perry, chemical engineer, the duPont company; Warren L. McCabe, chemical engineering head, Carnegie Institute of Technology.

Professor Hottel Receives W. H. Walker Award

CHICAGO.—For the best contribution to the chemical engineering literature over the pervious 3 years, Prof. Hoyt C. Hottel, director of the Fuels Research Laboratory of Massachusetts Institute of Technology, was awarded the William H. Walker Award, at the meeting of the American Institute of Chemical Engineers here December 18. This award is in honor of Dr. William H. Walker, once a professor at M.I.T., and one of the nation's outstanding chemical engineers. The paper which won the award covered new developments in radiant heat transmission, written in 1942, which presented charts by which radiant heat transmission can be calculated accurately from the products of fuel combustion. The paper was coauthored with R. B. Egbert.

Admiral deFlorez Speaks Before Chemical Engineers

CHICAGO. — Rear Admiral Luis deFlorez, holder of the Collier Air Trophy, chief of the Navy's Special Devices Division and assistant chief of the Office of Research and Invention expressed strong opposition to the proposed merger of the Army and Navy under a single head, when discussing synthetic training devices for the Navy before the thirty-eighth annual meeting of the American Institute of Chemical Engineers here December 18.

In an earlier statement the admiral has said that the Army should welcome competition with another service branch to bring out developments which otherwise might stay buried. Admiral deFlorez served in World War 1 in charge of aircraft instrument development. Later, as a civilian, he served as consultant for several large oil companies and is widely known in petroleum technological circles. Admiral deFlorez has had a large number of patents issued to him covering the deFlorez cracking process, the cylindrical furnace and still, used widely in refining, safety methods for testing high-pressure equipment and in other fields. He is a graduate of Massachusetts Institute of Technology, and the holder of a doctor's degree from Rollins College.

REAR ADM. LUIS DE FLOREZ

Kaiser-Frazer and Graham To Display New Cars

DETROIT. — The first new-name cars in America since the war will be displayed in the major U.S. cities in mid-January, according to Henry J. Kaiser, chairman of Kaiser-Frazer Corp., and J. W. Frazer, president of Kaiser-Frazer and of Graham-Paige Motors Corp. These will be the first new cars offered the American public by a new company in more than 10 years. At the same time Graham-Paige will introduce its new line of farm equipment which includes a newly engineered, general-purpose tractor, also two models of the Rototiller.

The entire Willow Run bomber plant, operated during the war for bomber assembly by Ford, will be devoted to the manufacture of the new line of equipment. The cars are designed by Howard Darrin, who, it is understood, has been designing automobiles for a quarter of a century. The two new cars are to be named the Kaiser and the Frazer, are to be powered by two different engines made by Continental Motor Co. A network of about 3,800 dealers has been arranged to market the new cars. They will be full American-size, six-passenger cars.

The new tractor will have four forward speeds, and will have two types of engines, one burning high-octane-number gasoline and the other a diesel using lower-grade fuel. A special low gear designed to allow take-off power for many auxiliary operations will be built into the tractor. Two types of wheel assemblies will be available also, one being the tricycle or three-wheel, and the other a four-wheel, adjustable-front-axle design. The powers of the various engines for these units have not been announced. The Rototiller is a wholly new design, built to do three farming operations simultaneously, plowing, disking, and harrowing. The large size has a "cut" of 5 ft. and will be tractor-attached. The smaller one will have two widths of cut, 20 and 26-in. for smaller capacity, with attachments of belt pulley, sickle bar, lawn mower, seeder and planter, row-crop cultivator, etc.

It is expected that the factory will be in full production by mid-March, and will be making 1,500 cars a day by the middle of the summer of 1946.

Army's Newest Bomber Powered by Six Engines

CHICAGO. — A total of six engines, generating takeoff power of 21,900 hp., will drive the new Army superbomber, the XB-36, through the air, announcements by the Army Air Force here revealed. This new air dreadnaught is a Consolidated-Vultee development and looks like a B-29, it is said.

The new ship weighs 250,000 lb., operates over a radius of 5,000 miles as compared with the B-29's 1,600-mile radius. A new departure is the placing of the engines in a position trailing the wing with the propellers pushing the craft instead of pulling from the leading edge of the wing. Its fuselage is 163 ft. by 150 in. diameter. Fore and aft compartments are connected, as in the B-29, by a pressurized tunnel. It is stated that the ship will operate at above 30,000 ft. elevation and that it can make nonstop flights from Tokyo to New York. Its regular crew will be 17 men, with berths and a galley.

The engines are Pratt & Whitney Majors, each having four banks of cylinders instead of the usual two banks as found in the largest power units at present. Its five tires—two each on the rear wheels and one on the front wheel of the tricycle landing gear—are 9 ft. 2 in. diameter, and weigh 1,500 lb. each.

It is stated that a transport model of this same plane, to carry 200 passengers, has been ordered by Pan American Airways.

Senate Committee to Open Oil Pact Hearing Jan. 21

WASHINGTON. — Public hearings before the Senate foreign relations committee on the ratification of the pending Anglo-American oil agreement adopted in London several months ago will begin January 21, Senate committee announces. The treaty will provide the collaboration of American and British interests in developing and operating oil resources throughout the world.

Pure Posts Revisions for Gueydan Crude-Oil Prices

Pure Oil Co. has announced the following posted prices for crude oil purchased from the Gueydan field, Vermilion Parish, coastal Louisiana: 20° to 20.9° gravity, 90 cents, with 2 cents additional for each degree to 40° gravity and above at $1.30.

FOUNDED IN 1910

BY PATRICK C. BOYLE

The OIL AND GAS JOURNAL

Dual Responsibility

THE first-hand reports from all parts of the world in this Annual International Number reveal unmistakably that the petroleum industry outside this country is entering the most promising period of its history.

The year just closing was prophetic of things to come provided obstructions are not placed in the way of operators who have been responsible through the years for the steady expansion in widely scattered global oil activities. Over the past 12 months new oil areas have been definitely established and the proven reserves of existing fields have been increased. Without including the output of fields which were in the hands of the enemy over part of the year, foreign petroleum output in 1945 will exceed any previous year.

Because a large part of the nondomestic supplies of petroleum was within the war area new development work in the early days of the emergency was generally below the prewar period. As the Allies gained control of the seas and transportation became more normal it was possible to expand shipments from foreign fields and this change in conditions has been reflected in field and plant activity over the past 12 to 18 months.

Foreign operations in the postwar period to a controlling extent are dependent on the attitudes of the governments concerned. Those countries whose petroleum laws and regulations enable operators to cope with the many operating difficulties will have the greatest expansion.

In this connection, it would be unrealistic not to recognize the fact that there are recent trends in government controls which are disturbing to those who have participated in foreign oil operations for many years. In their desire to carry out nationalistic policies, a few countries are in danger of setting up impossible barriers in the development of their oil resources.

Operators everywhere have exceeded the legal requirements in wage and salary scales and training programs for nationals covering the operating techniques of fields and plants. But there are limits as to what can be done in these matters and it must be realized that over-all labor costs are as direct a factor in foreign operations as in domestic activities.

While nationals are acquiring the routine skills those operations which necessitate scientific training and management experience must continue to be directed by the representatives of the American, British, and other owners. The petroleum arts from exploration through refining have been developed outside the countries in which the bulk of foreign production is coming and long experience has demonstrated that their application by those trained in the "know how" is fundamental wherever oil is found.

Labor regulations which in effect make it impossible for companies to employ trained administrators, geologists, chemists, and engineers from other countries will in the end defeat the nationalistic objectives of the governments concerned.

In the same category are the regulations which restrict the size and duration of exploratory rights and concessions. Operators must have sufficient time to carry on exploration and when they find oil they are entitled to the full fruits of their discoveries. There are also the matters of royalty payments and generally higher tax trends.

The dual functions of governments and operators have always been outstanding in foreign oil activities. This is no time for the responsibilities to become one-sided.

Brazil Shows Good Geologic Possibilities of Commercial Quantities of Petroleum

by Kenneth J. Langley

Operations in this largest and most populous country in South America are being intensified. The National Petroleum Council has contracted the services of exploratory experts from the United States to assist in carrying out the search for oil, total production of which was only 143,527 bbl. in 1944.

GEOLOGICALLY the possibilities of finding petroleum in commercial quantities in Brazil are great. Nevertheless, the surface indications of petroleum deposits are meager and seldom reveal the degree of positive evidence that is characteristic of the explored areas in the South American republics along the Andean belt or in some of the countries on the North American continent.

For more than 25 years the federal Government conducted exploratory activities in several states of the nation, but had no encouraging results until 1929. These exploratory operations were carried out along the Paraná Basin in conjunction with the governments of the states of Sao Paulo, Paraná, Santa Catarina, and Rio Grande do Sul. Similar operations were conducted throughout the states of Bahía, Alagoas, and Pará.

References to the possibilities of finding petroleum in the Paraná region date from the last century and are based principally on the appearance of tar or bituminous rocks in certain areas.

The geological series of interest in this basin belong to the Devonian and Triassic periods. The wells drilled by the Ministry of Agriculture in the states of Sao Paulo, Paraná, and Santa Catarina between 1918 and 1935 produced some oil and natural gas; but due to the fact that the drilling was done without the proper application of technical considerations, the results obtained failed to confirm the existence of petroleum deposits in the southern part of Brazil.

Drilling in the Candeias oil field, Bahia, Brazil. The climate here is very tropical

Gas well A-3 in the Aratu oil field, Brazil. The gas from this well is used as fuel to run the small topping plant installed in this field

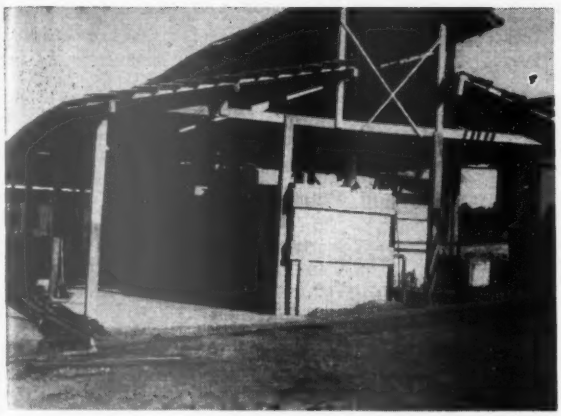
The first explorations conducted in the state of Bahia more than 25 years ago were carried out in Moraú. In the state of Alagoas, the area around the port of Maceió, was also explored in 1920. From 1924 to 1935 several wells were drilled in the valley of the Papajós River, state of Pará, next to the city of Monte Alegre. During the first year of the exploratory activities initiated in 1935, several wells were drilled in new areas such as the region of Cruzeiro do Sul and the territory of Acre. In 1936 more wells were drilled in Maceió, state of Alagoas, and in 1937, some throughout the area of Reconcavo in the bay of Todos os Santos, state of Bahía.

After deciding that it was advisable to have an agency exclusively in charge of the administration of the petroleum resources of the nation, the Brazilian Government created in 1938 the National Petroleum Council. This department, directly responsible to the president of the republic, was given technical and administrative control of all matters pertaining to oil, including natural gas, bituminous and pyrobituminous rocks, the manufacture of petroleum products, imports, exports, exploration, transportation, distribution, sales, and the levying of taxes.

On January 21, 1939, the Ministry of Agriculture brought in the first producing well in the area known as Lobato, in the neighborhood of Salvador, capital of the state of Bahía, and this well led the Government to believe that the first commercial fields of national importance would be found in this state.

The same year (1939) the Government transferred the entire management and execution of exploration activities throughout the national territory from the Ministry of Agriculture to the National Petroleum Council.

The council then initiated once more the search for oil in the states of Bahia and Alagoas with renewed vigor and determination. To carry out this program it imported some heavy rotary rigs, introduced new operating methods and technical improvements, and contracted the North American firms Drilling and Exploration Co., Inc., and United Geophysical Co. of Texas to drill the wells and conduct the geo-



Topping plant in the Aratu oil field, which has a daily capacity of 130 bbl.

Candeias No. 1 (C-1), discovery well of the Candeias field, now producing 30 bbl. per day

physical prospecting, respectively.

The exploration work in the state of Alagoas was continued until 1942. During that same year all the equipment and crews were transferred to the state of Bahia and the council concentrated all geological, geophysical, and drilling activities on this area.

The belt of Cretaceous sediments where these investigations were conducted comprises the Reconcavo region around the bay of Todos os Santos, an area which extends in a northerly direction for a distance of 644 miles until it reaches the San Francisco River.

Geologists conclude that the structure of the bay of Todos os Santos is a tectonic trough or graben, limited on the east and west by arcuated faults parallel to each other and 77 miles apart.

The drilling program which the National Council started in this region with two rotary rigs in 1939 is now being carried out by 10 rigs.

Up to the present, the following producing fields have been discovered in the state of Bahia: Lobato-Joanes (L), Candeias (C), Aratu (A), and Itaparica (I). Wildcats were also drilled on the following structures: Mata do Alianca (Al), Mata de Sao Joao (M), Camacari (Ca), and Maracangalha (Mr).

Lobato-Joanes Field

This field, located north of the city of Salvador, on the shore of the bay of Todos os Santos, became famous not only because of oil seepages known from long ago, but also because it was the field where the Ministry of Agriculture discovered, in 1939, at a depth of 700 ft., the first oil-producing sand in the Bazilian nation.

Seventeen wells were drilled in this field. Of these, five are still producing, two are exhausted, and the remainder were dry holes. The total footage drilled is 4,286 ft. The deepest well was drilled in the peninsula of Itapagipe. It reached a depth of 7,379 ft. and penetrated a few feet into metamorphic rock. Three saturated zones were tested in the stratigraphic series of the field. Of the three zones with evidences of good saturation, the lowest is the most productive, and consists, generally, of a medium granulated limestone, ashy-chestnut in color, with incrustations of a fine conglomerate. It produces a paraffinic oil which has a gravity of 33 A.P.I.

The Lobato-Joanes field is of little importance and its possibilities of expansion are well restricted.

Candeias Field

This field is located west of the village of Candeias, about 22 miles north-northwest of Salvador, and is connected with this village by a 37-mile railway and a 41-mile automobile highway. The structure on which this field is found is evidently a closed anticline. It is asymmetric and spacious. Oil seepages are found close to its axis.

The first well drilled in 1941 revealed a producing formation at a depth of 3,760 ft., the thickness of which was shown by later wells to have a maximum of 177 ft.

The producing zone consists generally of a well-consolidated sandstone, the texture of which varies from fine to coarse. Numerous lenses, laminations, layers of organic matter as well as conglomeratic sections are found interpolated in this formation. It produces a paraffinic oil which has a gravity of 26.6 A.P.I., a viscosity of 39.5 seconds Saybolt Universal, a freezing point of 37° C., and an oil and gas ratio of from 50 to 75 cu. ft. of gas per barrel of oil.

Up to December 31, 1944, a total of 11 wells were drilled and one was drilling. Total footage was 46,804 ft.

The Aratu Field

This field is located 12.5 miles north of Salvador, near the bay of Aratu. It is a gas and oil field with two producing horizons: a lower zone which produces gas and an upper which produces oil. The oil zone is lenticular and is found at a depth of from 1,500 to 1,600 ft. Only three wells have been drilled to this producing horizon. The gas zone was proven at a depth of from 2,349 to 2,526 ft. and eight wells were drilled to it.

The oil reserves are small. The oil has a paraffinic base and a gravity of 44 A.P.I. The gas reserves are estimated at 1 billion cubic meters with a pressure of 1,000 psi. Thirteen wells were drilled in this field, of which three came in as oil producers, seven as gas producers, and two as dry holes. Total footage was 32,918 ft.

Itaparica Field

This field is located in the northern extremity of the island of Itaparica, in the bay of Todos os Santos. It is found on an anticlinal structure, and up to December 31, 1944, 13 wells were drilled on it and 1 was drilling. Total footage was 39,536 ft.

Generally, the geological formation consists of Cretaceous sediments and has two pay sands: an upper which produces gas and a lower which produces oil. The oil has a gravity of 20 A.P.I., and a very high freezing point.

Mata de Alianca Structure

All the wildcat wells drilled on this structure gave negative results.

Mata de Sao Joao Structure

The deepest well in Brazil was drilled on this structure. It reached a depth of 8,035 ft., and was a dry hole.

Maracangalha Structure

One wildcat was also drilled on

this structure. Results were negative.

Camacari Structure

One wildcat showed that this structure is dry.

Stratigraphic Wells

Two stratigraphic wells were drilled in Cipo, a body of mineral salt water which is found near the banks of the Itapicuru River. One well was also drilled in Nova Soure.

Summary: Up to December 31, 1944, 63 wells with a total footage of 186,922 ft. were drilled in the state of Bahia with the following results:

Producing wells	23
Gas wells	10
Thermal water wells	1
Dry holes	25
Wells drilling	4
Total	63

Production

Wells are desinated by letters followed by a numeral which indicates its chronological order. The Lobato-Joanes wells are listed as L-1 up to L-17.

Wells L-3 and L-4 were the first to show commercial production in Brazil. Both wells are located in the site known as Lobato. Well L-3 was completed in December 1939, and immediately subjected to a series of tests. From January 1 to 14, 1940, the daily production of that well, in barrels, was successively as follows: 51.7, 12, 15, 15, 54, 6, 7, 7, 6, etc. The maximum pressure in the annular space between the tubing and the casing was 115 lb. The pressure in the tubing was 25 lb.

Well L-4, also subjected to several tests in March and April 1940, had a daily production—sometimes by natural flow and sometimes by swabbing—as follows: 444 bbl., 384 bbl., 180 bbl., 141 bbl., 96 bbl., 141 bbl., etc.

These wells were opened to regular production in August 1940, but it was established that they could only be pumped for a period of 8 hours or less per day in alternate periods of 2 or less hours each. The average production per hour in August 1940 was as follows: L-3, 0.66 bbl.; L-4, 3.27 bbl. In September 1940, the average production per hour was: L-3, 0.73 bbl., for a total of 166 pumping hours during the month; L-4, 2.6 bbl., for a total of 208 pumping hours during the month. During October of the same year, the average production per hour was: L-3, 1.2 bbl. for a total of 108 hours during the month; L-4, 2.6 bbl., for a total of 162 hours during the month.

Well L-3 kept producing until March 1942, date on which it was shut down. It was being pumped at the rate of 3 to 3½ hours every 24 hours. The average production was about 1 bbl. per hour, and the well was practically depleted.

Pumping of well L-4 was suspended in December 1941, and abandoned as exhausted.

The other producing wells in this field are L-12, L-13, L-14, L-15, and L-17, all located in the site known as Ilha de Joanes. L-12 is practically depleted. On December 31, 1944, L-13 had a potential daily production of 5 bbl.; L-14, 20 bbl.; L-15, 60 bbl.; and L-17, 25 bbl. The total daily potential production of the entire Lobato-Joanes field on the same date was 110 bbl.

Candeias Field

The wells corresponding to this field are designated by the letter C. Up to December 31, 1944, 12 wells had been drilled: C-1 to C-12. The latter well was still drilling in 1945. The daily potential production of this field as of that date was:

	Bbl.
C- 1	30
C- 2	25
C- 3	15
C- 4	30
C- 6	30
C- 8	30
C- 9	75
C-10	125
C-11	75
Total, 9 wells	435

Aratu Field

The wells corresponding to this field are desinated A-1 to A-13. This field has been completely explored. The daily potential production as of December 31, 1944, was as follows:

	Bbl.
A-1	15
A-2	15
A-5	5
Total, 3 wells	35

Itaparica Field

The wells corresponding to this field are designated I-1 to I-14. The daily potential production as of December 31, 1944, was as follows:

	Bbl.
I-2	50
I-3	60
I-4	3
I-7	30
Total, 14 wells	143

OIL PRODUCED FROM 1940 TO 1944 IN BARRELS

Field	1940	1941	1942	1943	1944	Total
Lobatos-Joanes	2,089.12	2,931.50	6,947.91	15,639.80	20,925.58	48,533.91
Candeias		188.50	10,037.37	15,212.45	18,376.03	43,814.35
Aratu			13,556.61	14,496.66	9,806.48	37,859.75
Itaparica			2,089.53	2,804.38	8,425.68	13,319.59
Grand total						143,527.60

Summary:

	Bbl.
Lobatos-Joanes	110
Candeias	420
Aratu	32
Itaparica	143
Total	705

To these figures should be added the production of the new wells discovered in Candeias and Itaparica. This will raise the total potential daily production for the four fields to more than 800 bbl.

Operations to refine this crude are still in their infancy. There is a small experimental topping plant in the Aratu field run with fuel provided by the natural gas from well A-3. This plant has a capacity of 130 bbl. of crude daily.

The oil from all four fields has a paraffinic base, other characteristics varying from field to field. The following is the laboratory analysis of the Lobato-Joanes field:

	Per cent
Gasoline up to 204° C.	15
Kerosene up to 268° C.	15
Diesel oil up to 310° C.	5
Residual oil	65
Paraffin	22
Sulfur	0.13

The oil from the Candeias field has a low gasoline content, that is, about 12 per cent.

Outlook

Operations are being intensified. Further exploration is being conducted to study the structural geology of the entire belt from the bay of Todos os Santos, on the south, to the San Francisco River on the north.

To make sure that the latest methods and technical knowledge will be used in carrying out these studies, the National Petroleum Council has contracted the services of DeGolyer & MacNaughton, of Dallas, Tex., to supervise all activities related to operations, and the geological work. Besides H. A. Garner, the geologist representing the firm, another American geologist, H. P. Keller, has been contracted, and several other important scientists have been invited to become associated with the council in developing this work. Schlumberger Surenco S. A., from Caracas, Venezuela, has also been contracted to do the electrical logging of all the wells now drilled in the state of Bahia.

Schist Production Is New Development at Edison

by L. P. Stockman

THE Edison field, 12 miles southeast of Bakersfield, Calif., is undergoing a rejuvenation process both interesting and important from a production standpoint. The operators are developing new reserves from a fractured, weathered schist basement. It also points to similar possibilities along the east side of the San Joaquin Valley and perhaps elsewhere.

Everyone would like to know what the "deepest chances" are for their oil wells. Granite or basement complexes usually are considered the final stopping place. This article describes development in an old California field where the new zone is a fractured schist within the Franciscan basement.

Production More Than Doubled

Edison was discovered by Shell Oil Co., Inc. and L. C. Osborn in January 1934, and has produced 13,038,170 bbl. to November 1, 1945. Production has risen from 3,683 bbl. per day in January 1945 to the present 8,563 bbl. as a result of the schist development at Edison and the drilling of two small adjacent pools. The latter has been by Richfield, General Petroleum, J. Paul Getty and others. If the fractured schist production conforms with past performances at Playa Del Rey in the Los Angeles Basin, and at Santa Maria Valley in the Coastal district, it should prove important.

At Playa Del Rey, production was developed in both fractured schist and basal conglomerate, with some few wells finding good production in the fractured schist where the conglomerate was missing or very thin. At Santa Maria Valley, development work started several months ago which involved the Knoxville sandstone and fractured Franciscan basement. A number of excellent flowing wells have been completed in the basement rock, although the productive area is indicated to be limited in extent. Until the operator drills into the Franciscan for a hundred feet or so, it is not known whether there might be a fractured zone present below the top.

Character of Structure

At Edison, successful development has been restricted to within Sections 11, 13, 14, and 24-30s-29e, M.D.B.&M. Outer limits have been defined to the west by a dry hole of Shell in Section 15 and to the southwest by Jergins Oil Co.'s 25 Texas fee which found the zone wet in Section 23-30s-29e. A fault outlines the northeast side of the field.

Well spacing at Edison has been 1 well to 10 acres but with the new zone opened up, the surface pattern probably will be substantially reduced, although relatively wide spacing will be the rule for the schist zone. Redrilling and deepening of old wells has already changed the spacing and further change can be anticipated. Previously, Edison producing depths were from 1,250 ft. on the east side to about 2,500 ft. on the west.

The structure is a southwest dipping monocline although in certain areas there are rapid lithologic changes and a progressive overlap condition. Top of the schist basement presents an undulating surface but the schist mass, conforming generally with the monoclinal structure of the field, rises to the east and northeast.

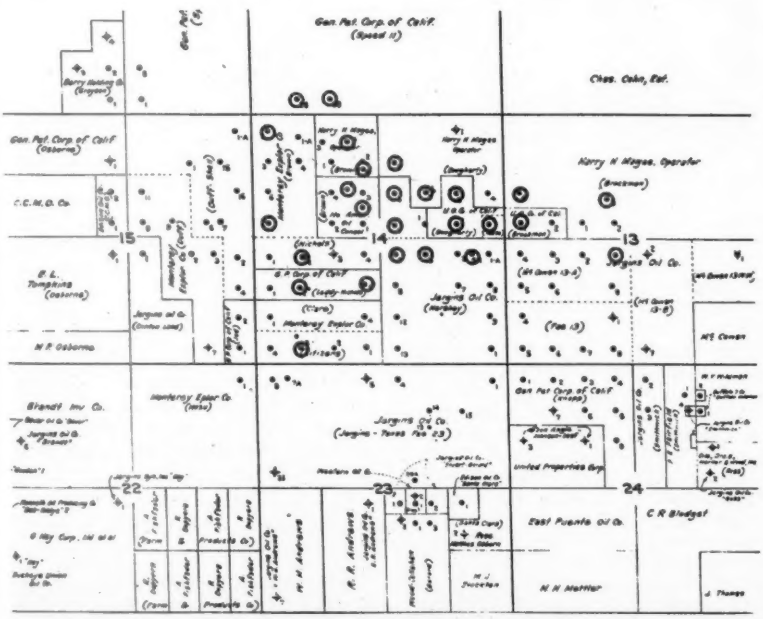
Rather Large Penetrations Taken

Smallest penetration taken in the fractured schist to date is 90 ft. and the maximum penetration is 880 ft. Average to date approximates 375 ft. and suggests a favorable recovery per acre. There appears to be a direct relationship between penetration and initial daily production, but substantial initials are not restricted to any particular interval. Dominating influence appears to be the degree of fracturing and amount of schist present. The fractured and weathered schist is found immediately below a relatively thin but hard schist member and penetration taken depends upon the thickness of the fractured zone.

As soon as the massive schist basement is reached, drilling operations are concluded and casing landed a few feet above the top of the fractured schist. Casing program for new wells is usually 10¾-in. for surface pipe, 7-in. casing, and a 5½-in. liner through the productive zone. In many cases, the 7-in. combination string includes the perforated section and after being landed is cemented through perforations at a pre-selected point.

The formations are conducive to fast drilling and free of sloughing material such as bentonite and other similar formations. Rock bits are used throughout and very little mechanical difficulties are encountered. Average time to complete is 3 weeks. The penetration of 350 ft. of fractured and weathered schist takes about 2 days, depending to some extent on the degree of fracturing.

Highest point of contact with the fractured schist to date is 1,547 ft.



Circles show wells deepened or drilled to newly found reservoir in fractured schist basement rock at Edison

(east) and the lowest is 2,950 ft. (west). Deepest completion is 3,022 ft. and the shallowest is 2,300 ft. Largest initial production is 2,640 bbl. Several wells have initials up to 2,000 bbl. per day. Average initial has been around 650 bbl.

Originally a total of 1,500 acres were found productive at Edison in one or more of the upper zones, and the latest developments indicate the schist production will be found on approximately 1,000 acres. On a recovery basis of 15,000 bbl. per acre, the new work at Edison will add 15,000,000 bbl. of reserves. This is just about equal to the field's past production from the upper zones.

Council Shelves Idea of Permanent Oil Agency

WASHINGTON. — The Petroleum Industry War Council is now in process of liquidation, with no definite plans in prospect to form a permanent organization to continue its functions of liaison between the Government and the oil industry.

At its December 12 meeting the council adopted a resolution to terminate its formal existence immediately, subject to approval of the Petroleum Administration for War, appointed Chairman Boyd as liquidating agent and trustee, and directed him to wind up affairs as rapidly as possible. An order was being prepared in PAW rescinding as of December 31, Recommendation 24 which authorized appointment of PIWC and outlined its functions. A similar order was being prepared regarding Directive 70 which set up the foreign operating committee.

Liquidating the affairs of PIWC is expected to take several weeks, and the American Petroleum Institute probably will then take over its suite to house the proposed A.P.I. Washington branch office.

The PIWC committee on a continuing organization, headed by W. Alton Jones, president of Cities Service Co., recommended creation of a permanent national petroleum council. The idea met general approval but there were some objections, so it was agreed that the Jones committee would continue to study the proposal as a group of individuals.

A revised plan probably will be submitted to former PIWC members by mail and if approved the Jones committee will call an organization meeting.

The general proposal is that the new body not perform any of the usual functions of existing trade associations but be set up to represent all existing trade associations and all segments of the oil industry. Its purpose would be to serve as a channel of contact with government agencies dealing with oil and gas matters to consult on national problems and make recommendations regarding industry points of view on government proposals and policies.

Lead Quotas Are Reduced For Making Tetraethyl

WASHINGTON.—Lead allocations to producers of tetraethyl for gasoline will be reduced in the first quarter of 1946 to 80 per cent of the estimated amount used in the fourth quarter of 1945, Civilian Production Administration announces. Reductions also will be made in allocations to producers of passenger-car batteries. Quotas for the manufacture of industrial-type batteries, cable coverings and collapsible tubes will continue unchanged.

Other changes in permitted lead uses included a revocation of the lead chemical conservation order (M-384) and the incorporation of its provisions on a more restrictive use basis under M-38. Under the new provisions unused quotas of lead chemicals during any quarterly period cannot be added to the quota of the following quarter.

Two minor relaxations in the amended lead order permit the use of lead foil in chrome plating, and for experimental purposes up to 500 lb. quarterly.

DEATHS

Lloyd Nelson Hamilton, 54, board chairman of The Bahrein Petroleum Co., Ltd., and internationally known, died December 23 in New York. Born in San Francisco, Hamilton's entire business career was spent with Standard Oil Co. of California, which, jointly with The Texas Co., controls Bahrein. After attending University of California, where he was elected to Phi Beta Kappa, Hamilton saw overseas service in World War I as an infantry captain. Following the war he attended Oxford University for a time and then returned to finish his studies at University of California, where he graduated as a doctor of jurisprudence in 1920. He was soon sent to South America by California Standard and spent 1922 in Ecuador and Colombia in lease and contract work. Returning to San Francisco, he was attached to the foreign producing department till 1932. Transferred to London in that year, he was made a director of California Standard Oil Co., Ltd.. in charge of its London office. He assisted in negotiations with the British Government regarding modifications of the Bahrein concession, and he was sent to Saudi Arabia when negotiations were opened with King Ibn Saud for development of his country's oil resources. Hamilton was largely instrumental in effecting Ibn Saud's decision to make an agreement with Standard of California. The outcome of this agreement is today's Arabian American Oil Co. jointly owned by Standard of California and The Texas Co. Subsequently, Hamilton devoted much time to the Middle East. He was in London, negotiating with the governments of Great Britain, Palestine, Transjordan, Syria, and Lebanon, for rights-of-way to build a pipe line from Saudi Arabia to the Mediterranean, when stricken last September and was flown to New York.

John Paul McClintock, 63, general superintendent of Colorado Interstate Gas Co., died recently. McClintock started as a civil engineer with South Penn Oil Co., and also worked for Hope Natural Gas Co. in Clarksburg, W. Va. He joined Colorado Interstate in 1927.

Clarence O. Doss, 55, died December 21 in Oklahoma City. He organized Doss-Jones Oil Co. in 1932 and was an independent operator at the time of his death.

Frank P. McNellie, 72, retired oil man, died December 18 at Oil City, Pa. He operated an extensive lease at Petroleum Center, Pa., until his retirement 15 years ago.

John J. McCrea, 40, Oklahoma district superintendent for Stanolind Oil & Gas Co., was killed in an automobile accident near Seminole, Okla., December 17. McCrea joined Stanolind when the Standard Oil Co. of Indiana absorbed Mid-West Refining Co. He went to Fort Worth with Stanolind in 1933 as chief clerk for the North Texas-New Mexico production division, and in 1943 was made division manager of the industrial relations office of the company. Later he was transferred to Tulsa as Oklahoma district superintendent.

Lucien T. Peabody, 56, Bradford, Pa., oil man, died December 14.

Frederic A. Fleming, 52, Houston independent oil man, died December 17 from injuries suffered in an automobile accident in Green Cove Springs, Fla.

Harry Snider, 73, drilling contractor, died December 20 in Wichita, Kans.

Marvin K. Clover, 79, retired president of Iron Mountain Oil Co., died December 24 in St. Marys, Ohio. From 1920 to 1940 Clover was an active oil operator in Tulsa.

INTERNATIONAL SECTION

The Oil and Gas Journal • December 29, 1945

INTERNATIONAL SECTION

AN upsurge in foreign refinery construction, capacity and operation is probably the most clean-cut trend in world petroleum affairs to assume positive form since conclusion of the war.

There are at least four obvious reasons for the swing of refinery construction and capacity away from the United States to other sources of petroleum throughout the world.

1. Reconstruction of war-damaged plants in Europe and the Far East constitutes a requirement which will eventually cost a half billion dollars.

2. All foreign refineries undamaged by direct military action will require complete rehabilitation and modernization.

3. Foreign oil-producing countries are embarked on an unretractable nationalistic policy, requiring producing companies to complete integration of operations, embracing manufacturing and internal distribution.

4. Increased world consumption of petroleum products has much greater potential in foreign countries where the per capita use of oil is a small fraction of that prevailing in the United States.

The most substantial wartime increase in refining capacity was concentrated in the Middle East. Current capacity of Middle East refineries is approximately 65 per cent higher than in 1939. Additional plants are projected which will nearly double the prewar operating capacity of manufacturing facilities in that part of the world.

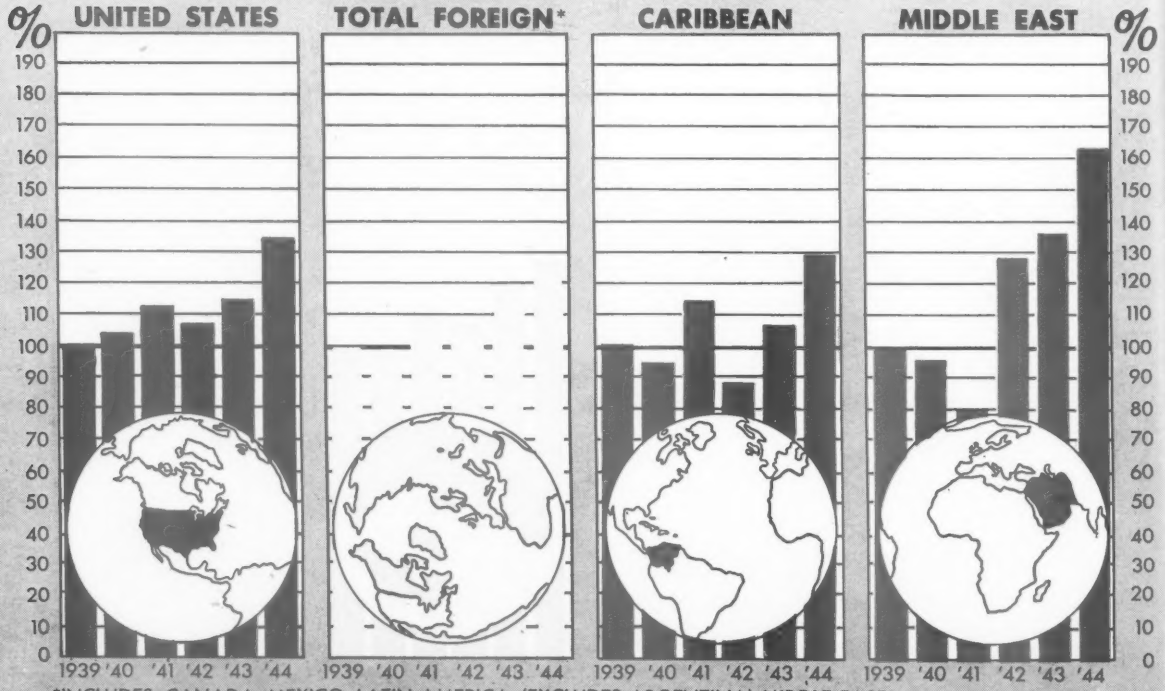
Much of the refinery expansion in the Middle East is a direct result of higher rates of production and expanded reserves developed immediately before and during the war. Economics of international-petroleum trade are particularly attractive to the establishment of refining facilities at the source of crude-oil supply.

Artificial regulations in the form of special taxes on imported products or other barriers to petroleum trade in countries deficient in indigenous oil supplies frequently prevent full adoption of the most economical operation. Practically all western European countries are forced to import all or a substantial percentage of their petroleum requirements, either in the form of crude or products. France, as one example, resorted to artificial regulations in prewar years to force establishment of a refining industry within its borders. The difference in lower taxes on imported crude and higher levies on imported products more than offset the transportation costs on 5 to 20 per cent of the gross oil which is consumed as fuel or is lost in the refining process.

Chief emphasis was placed on primary distillation equipment in the $250,000,000 foreign refinery construction program during the war. This accounts for the relatively high percentage increment in crude-oil capacity in foreign plants compared to the United States where emphasis was concentrated on aviation-gasoline and synthetic-rubber facilities. The speciality plants contributed nothing to increasing crude-oil capacity.

WARTIME CHANGES IN WORLD REFINERY OPERATIONS

BY PERCENTAGES—PRINCIPAL AREAS



*INCLUDES: CANADA, MEXICO, LATIN AMERICA, (EXCLUDES ARGENTINA) MIDDLE EAST
EXCLUDES: CERTAIN SMALL REFINERIES FOR WHICH NO DATA ARE AVAILABLE

C. Stribling Snodgrass, director of the Foreign Refining Division, Petroleum Administration for War, had this to say about foreign refinery operations, construction and probable trends in his final summary before the O'Mahoney oil committee:

Caribbean Area

"During the early days of the war, the shortage of tankers and the relatively greater distance from the Carribbean area to the fighting fronts, as compared with shipping routes from the United States prevented the Aruba, Curacao, and Trinidad refineries from making their maximum contribution. During 1943, 1944, and 1945, however, expansion of the United Nations tanker fleets, together with the development of military operations, completely changed the Caribbean situation. During the first 8 months of 1945, refineries in the area operated virtually at maximum capacity, limited only by the irregularities in offtake which continued to presist as the ever-increasing demand for products outstripped the tanker building program.

Middle East

"Until the summer of 1943 the situation in the Middle East was dominated by the closing of the Mediterranean route to tanker traffic. To serve the North African and Western European theaters from the Middle East by shipping around the Cape of Good Hope would have involved a prohibitive waste of tanker capacity. Middle East refineries turned out about 53 per cent more refined products in 1943 than in 1938, and the corresponding increase was 89 per cent for the year 1944.

War Record of Foreign Plants

"All in all the wartime record of the United Nations' foreign refineries is one which will stand up favorably under the closest scrutiny, even when judged by the exacting yardstick of what was done by the industry here at home. Within the limitations that have been described, full scale operation was always the order of the day, in spite of severe difficulties and hardships. Nor was the strain upon foreign refineries lessened by the ending of hostilities in Europe. Had the Japanese war continued longer, not only would the increased demands of a single-front war have taxed the United Nations' over-all refining capacity to even greater limits, but nearly all of the increased load would have had to be borne by overseas refineries, since the output of United States refineries during the first half of 1945 represented the peak that could be expected of them. The forward program through 1946 called for a further substantial increase in foreign throughput.

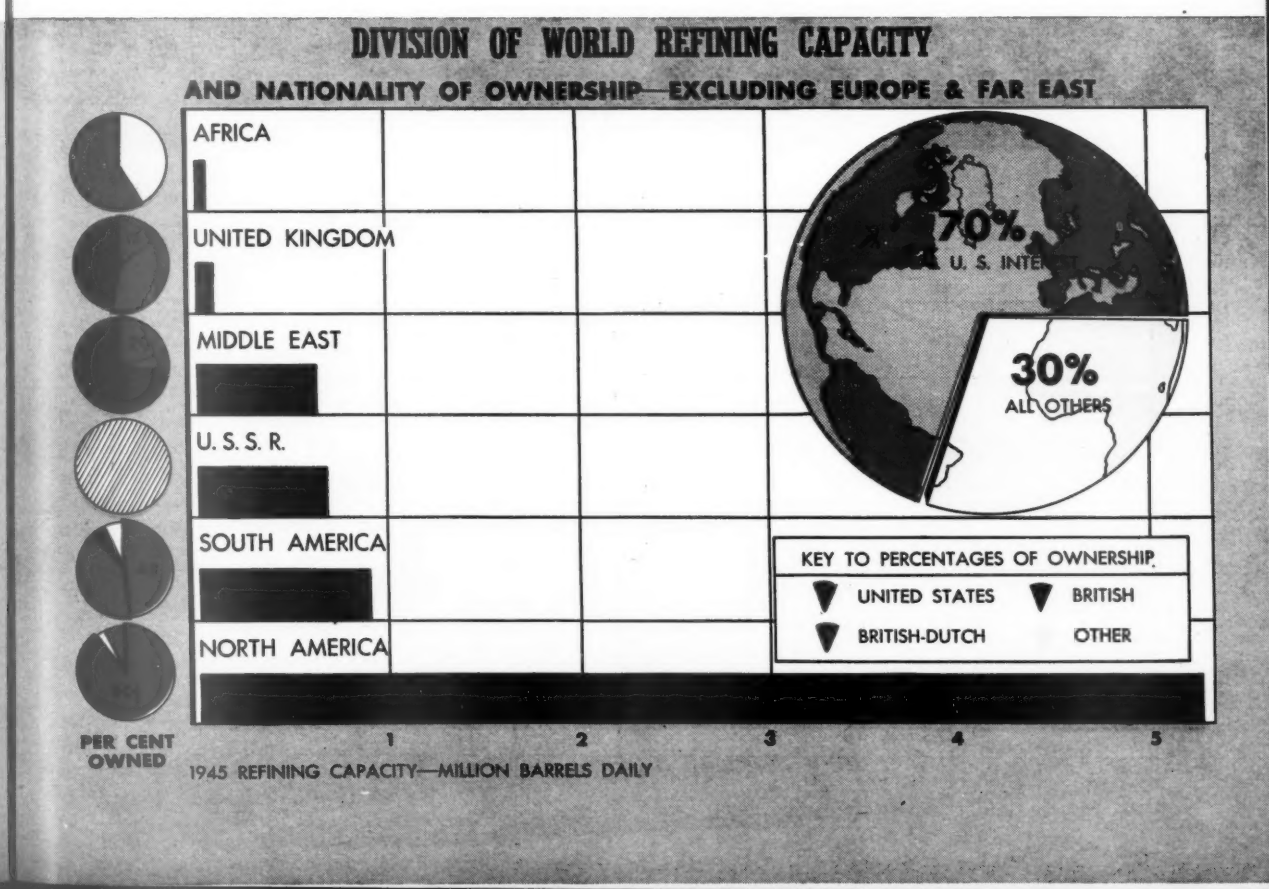
Aviation Gasoline From Abroad

"Something has already been said about the wartime need for special military products, and here it is natural to think first of aviation gasoline. The foreign refineries contributed their full share of this vital product. In addition to the use of prewar facilities, a major construction program was undertaken. Despite the many obstacles to overseas construction in wartime, facilities built during the war contributed materially to wartime supply and at the war's close other important installations were nearing completion. By the end of 1945, if the war had continued, facilities for manufacturing 100-octane gasoline in the Caribbean Area, United Kingdom, and Persian Gulf, nearly all of which were erected during the war, would have been making at least 14 per cent of the entire United Nations' output. As it was, they were turning out about 12 per cent of the total in the month before V-J Day.

Wartime Construction

"In the few years preceding the war, there was a trend toward expansion of refining facilities abroad at a much greater rate than in the United States. During the war that trend continued.

"It is true that during the war nearly four times as much money was invested in new plant construction in the United States as was invested in new foreign facilities. In this country, however, the program was mainly devoted to a tremendous 100-octane plant develop-



ment, with relatively little construction of new primary distillation units. Foreign refiners, on the other hand, while they also built many large aviation gasoline units, undertook a number of general expansion projects to provide for greater crude intake capacity. In some cases this was due to the fact that the over-all United Nations' program required the erection of new primary facilities to provide a full line of products in increased volume; in other cases additional crude distillation capacity was needed to furnish sufficient feed stocks for aviation gasoline facilities.

"These projects were carried out by the British, British-Dutch, and American interests, and it may be well to note that no lend-lease aid was extended to Great Britain or Holland for refinery expansion projects of a capital nature. Within the scope of this statement, specific mention can be made of only a few outstanding projects in the foreign wartime program.

Caribbean Area and Mexico

"In the Caribbean area, important aviation gasoline facilities were erected at both Aruba and Curacao. A British company in Trinidad operated a large 100-octane installation which the British Ministry of Aircraft Production had just finished building at about the time of Pearl Harbor. Some increase in crude intake capacity was also provided at Curacao as well as at an American-owned refinery on the Venezuelan mainland, but these two projects only augmented the crude-intake capacity of the whole area.

"In line with United States Government policy of providing facilities for the manufacture of 100-octane gasoline in Mexico, credit was extended to that country early in 1944 for the purchase of refining equipment in the United States. Rehabilitation of an existing refinery was necessarily involved, and since this will help to provide for Mexico's internal needs, it would have lessened that country's wartime demand for exports of products from the United States. The American Government had an option to purchase one-half of the output of aviation gasoline from this refinery. Completion of the whole project was scheduled for early in 1946.

Europe

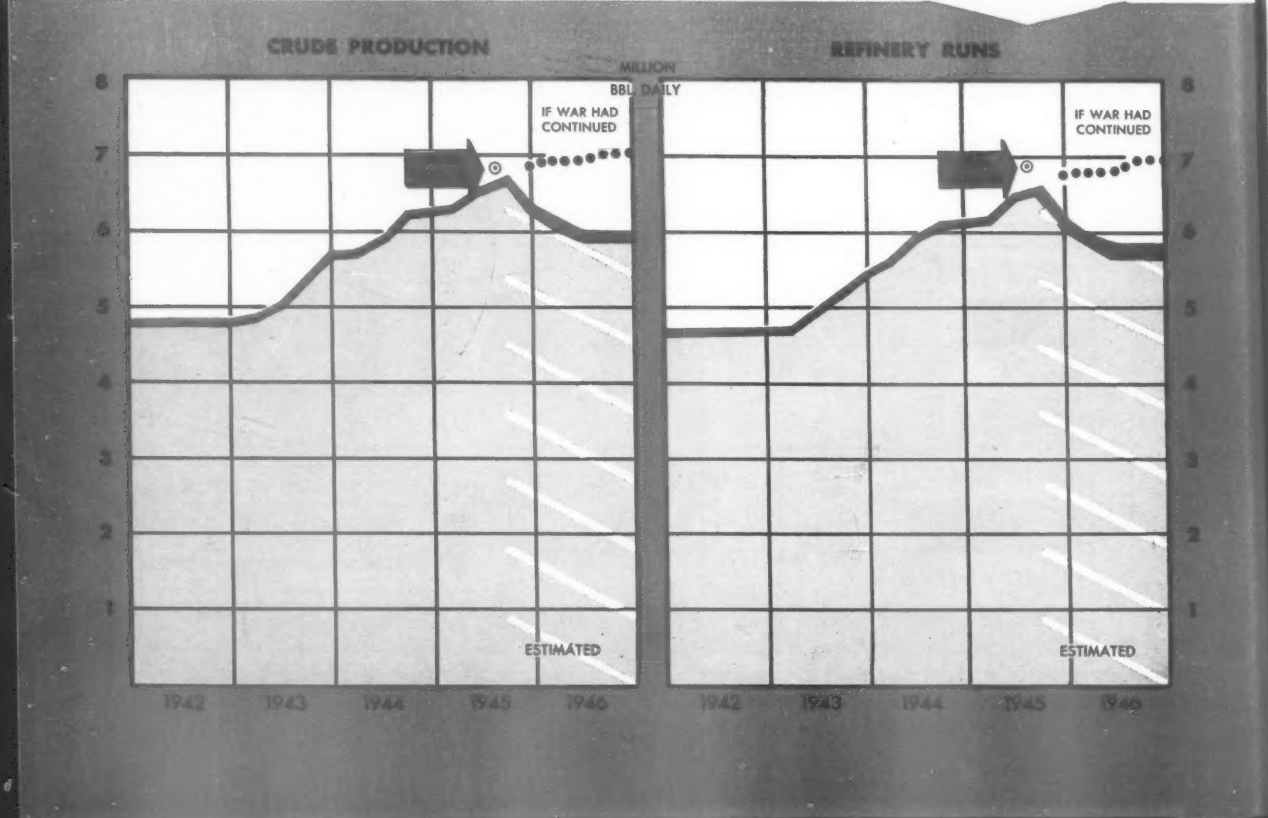
"Although the United Kingdom made a substantial contribution to the 100-octane gasoline program, this came largely from installations completed before or early in the war. One of these installations, the Heysham plant, is of special interest in that it was designed and built from the start as a war area project, with provision for the greatest possible security against detection, bombing, and sabotage. This plant ran on feed stocks imported from the United States. Equipment for a wartime refinery construction program was supplied to Russia from the United States under the Second Protocol. It was estimated that this equipment, when erected, would provide for about a 4½ per cent increase in crude throughput capacity for the Russian industry, with additional facilities for making special war products including 100-octane gasoline. None of the new facilities was in operation by the time of V-J Day. Additional equipment, originally contemplated for lend-lease shipment under the Third Protocol, has all been stockpiled in the United States, pending the outcome of current negotiations for cash purchase by the Russians.

Middle East

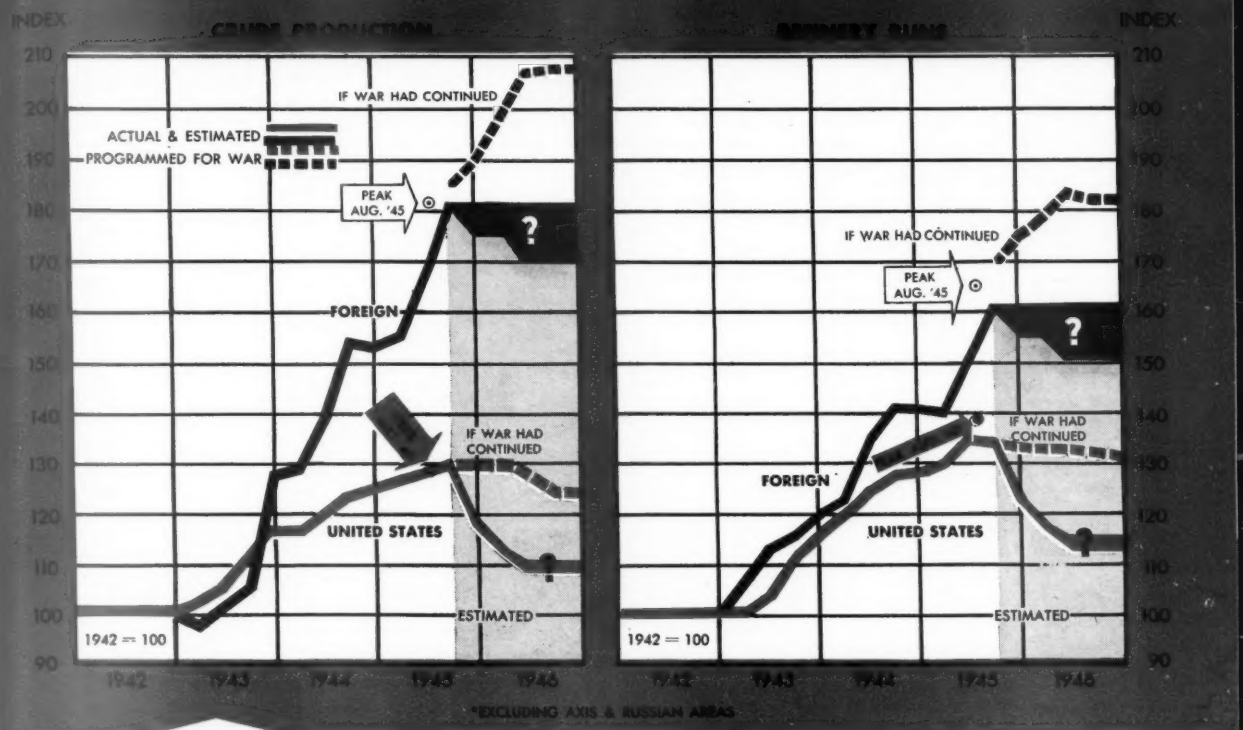
"In the Middle East, there was a greater wartime development of new crude-intake capacity than in any other part of the world, as well as major construction of facilities for aviation gasoline production. By the end of the war, all important segments in the program either had been completed or were scheduled for completion at an early date. As a result, refining capacity in the Persian Gulf-Levant area was increased by at least 43 per cent between 1939 and 1945, and potential output was raised from about 8½

PETROLEUM PRODUCTION AND REFINERY RUNS

(World—Excluding Axis and Russian Areas)



ESTIMATED WORLD-WIDE REQUIREMENTS OF MAJOR PETROLEUM PRODUCTS, EXCLUSIVE OF RUSSIAN CONTROLLED AREAS, 1946



INCREASE IN PETROLEUM PRODUCTION AND REFINERY RUNS

(United States vs. Foreign)*

per cent to 12 per cent of total current output in the United States.

"Since practically the entire production of Middle East refineries is available for export, the new output would have been especially helpful if the war had continued, because of the favorable location with respect to the Pacific war. Both British and American companies participated in the program.

"At Haifa, Palestine, new equipment completed in 1944 now enables that refinery to absorb nearly the maximum throughput of the Iraq pipe line. At Abadan on the Persian Gulf a series of 100-octane gasoline projects were undertaken, as well as a general expansion in crude throughput capacity (about 20 per cent) completed in early 1945.

"New aviation gasoline facilities at Bahrein, together with equipment which roughly doubled that refinery's crude-oil intake capacity, were brought into operation during the last year of the war. Finally, an entire new refinery is now nearing completion in Saudi Arabia, near the site of a very small prewar plant at Ras Tanura. Completion of this project was scheduled for the end of 1945.

Ownership of World Refineries

"The chart, entitled "Division of World Refining Capacity," shows the 1945 distribution of refining capacity in several main areas of the world, broken down by nationality of control (American, British, British-Dutch, and others). Before pointing out the significant features of this chart, it may be well to emphasize that as with all data on refining capacity, the indicated quantities and percentages are no more than rough approximations. This is because the crude-intake capacity of a refinery is not a fixed quantity, but ranges between wide limits depending upon a number of variable factors, such as the type of crude to be run and the variety of products desired.

"Uncertainty as to the future of many installations in Europe and the Far East has made it advisable to limit the scope of the chart to the Western Hemisphere, the United Kingdom, Russia, Africa, and the Middle East. However, the overwhelming preponderance of the domestic industry in world refining and the important share of American capital in foreign refining both are clearly evidenced. Particularly it should be noted that ownership by American interests amounts to nearly 48 per cent of refining capacity in South America. American companies also operate about 20 per cent of total capacity in the Middle East, as compared with only 7½ per cent (of a much smaller total amount) in 1938. Over-all, for the areas specifically mentioned, American companies own or control about 35 per cent of all foreign refining capacity and about 70 per cent of total world capacity.

Future Construction Trends

"Certain general factors will determine the course of postwar world refinery construction. Some of these factors can be predicted with reasonable accuracy; others lie within the realm of mere speculation. Nevertheless, it is worth while at least to enumerate them.

"The first factor is the capacity of world markets to absorb refined products. As already stated, there now exists a world-wide surplus of refining capacity in relation to the prewar consumption of finished products. A rapidly rising trend in postwar world consumption, however, is being widely predicted.

"Next, many existing refineries in foreign countries are in need of extensive replacement and modernization of worn out and obsolescent facilities. Six years is a long time in the life of a refining unit. The high rates of throughput during the

ESTIMATED WORLD-WIDE REQUIREMENTS OF MAJOR PETROLEUM PRODUCTS, EXCLUSIVE OF RUSSIAN CONTROLLED AREAS, 1946

(Thousands of Barrels Daily)

Requirements—Civilian—	100 octane	Other aviation	Motor gasoline	Total all gasolines	Kerosene	Distillate & diesels[6]	Residual fuel oil	Total major products
United States	3	20	1,641	1,664	199	511	911	3,285
Alaska and Hawaii	..	..	4	4	1	3	11	19
Canada	..	1	77	78	3	21	22	124
Mexico	1	..	20	21	5	6	61	93
Latin America and West Indies	..	1	66	67	15	31	130	243
U. K./Eire	..	..	120	120	17	51	27	215
Northwest Europe[1]	..	1	79	80	16	47	51	194
Med. Europe and North Africa[2]	..	1	42	43	9	26	46	124
West and Central Africa	..	..	3	3	1	1	..	5
South and East Africa	..	..	18	18	2	4	..	24
Eastern Med. and Middle East[3]	..	1	10	11	14	13	29	67
India and Ceylon	..	..	12	12	20	8	15	55
Australia and New Zealand	..	..	28	28	2	12	1	43
Far East[4]	..	2	14	16	13	17	17	63
Total civilian	4	27	2,134	2,165	317	751	1,321	4,554
Bunkers for ocean vessels—								
United States ports	..	..	....	....	..	16	209	225
Foreign ports	..	..	....	....	..	51	222	273
Total bunkers	..	..	....	....	..	67	431	498
Military—World wide	138	17	141	296	12	90	234	632
Total requirements	142	44	2,275	2,461	329	908	1,986	5,684

(1) Includes Northern France, Netherlands, Norway, Belgium, Denmark, Sweden, and allied zones of occupation in Germany and Austria. (2) Includes Southern France, Italy, Greece, Yugoslavia, Spain, Portugal, Switzerland, Algeria, Morocco, and Tunisia. (3) Includes Eastern Med., Aden, Red Sea area, Iran, and Iraq.

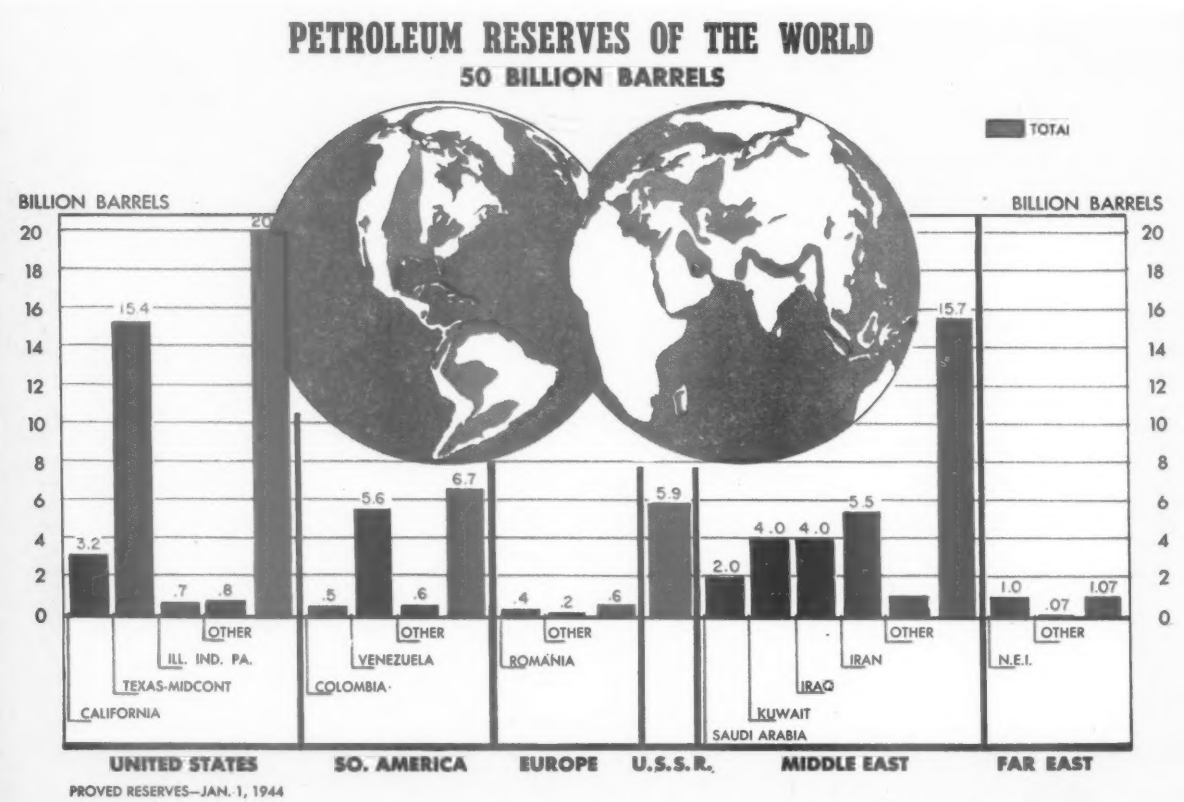
war played havoc with the physical condition of equipment, and the ever continuing progress of technological development has rendered many prewar installations out of date. Consideration will need to be given, for example, to the installation of catalytic cracking units in many refineries that do not have them.

Many refineries, both in Europe and the Far East, moreover, were so seriously damaged as to require major reconstruction rather than mere repair, while some must be rebuilt from the ground up.

Venezuela Construction

"A notable postwar development will certainly be the building of new refineries in Venezuela, in line with the policy of the Venezuelan Government. In fact, three American companies and one British company have already announced plans for building new installations in that country with an aggregate crude intake capacity of about 140,000 bbl. per day, to be completed not later than 1951.

"Significantly, no major plans have yet been announced for the general rehabilitation of American-owned refining properties in Europe. Plans for those countries must presumably await the stabilization of political and economic conditions. On the other hand, rehabilitation proposals for the East Indies were well formulated at the time of V-J Day, and engineers are already on the ground for the rebuilding of the

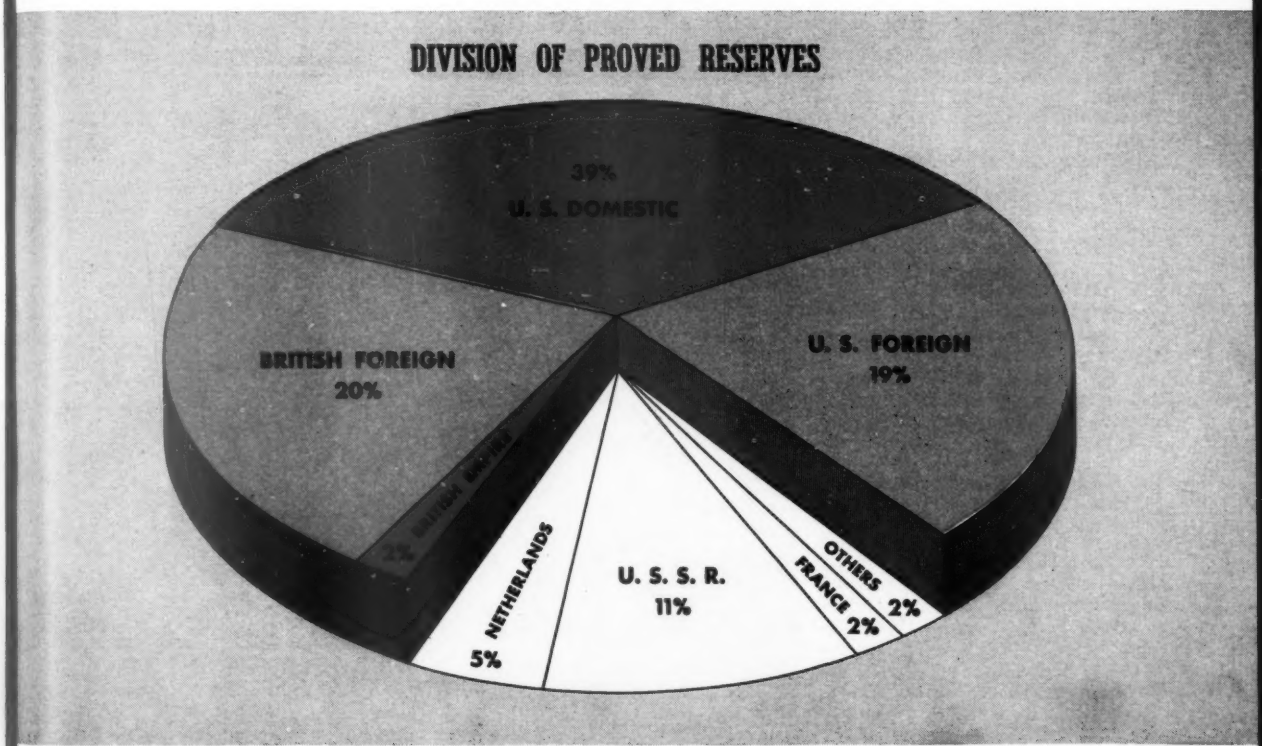


ESTIMATED WORLD-WIDE SUPPLIES OF MAJOR PETROLEUM PRODUCTS, EXCLUSIVE OF RUSSIAN CONTROLLED AREAS

(Thousands of Barrels Daily)

Supplies—New supplies—	100 octane	Other aviation	Motor gasoline	Total all gasolines	Kerosene	Distillate & diesels*	Residual fuel oil	Total major products
United States	63	30	1,785	1,878	236	650	1,124	3,888
Caribbean area	15	8	110	133	23	76	442	674
Eastern Mediterranean[5]	..	..	24	24	14	12	52	102
Persian Gulf and India[6]	21	5	101	127	29	83	201	440
Canada	1	1	75	77	3	24	33	137
Mexico	1	..	19	20	5	11	70	106
Other Latin America	..	..	43	43	7	18	46	114
U.K. and Western Europe	5	..	59	64	4	20	39	127
Far East[7]	..	..	20	20	2	11	31	64
Total new supplies	106	44	2,236	2,386	323	905	2,038	5,652
Stock (draft) or buildup—								
United States	..	..	(39)	(39)	(3)	(3)	47	2
Other[8]	(36)	..	....	(36)	(3)	..	5	(34)
Total stock change	(36)	..	(39)	(75)	(6)	(3)	52	(32)
Total net supplies	142	44	2,275	2,461	329	908	1,986	5,684

(4) Includes China, Japan, and liberated areas. (5) Includes Iraq, Palestine, Syria, and Egypt. (6) Includes Iran, Bahrein Is., Saudi-Arabia, and India. (7) Includes Netherlands East Indies, Borneo area, Australia, and China. (8) Includes changes in military stocks worldwide and seasonal changes in foreign civilian stocks. *Includes vaporizing oil.



large American refinery in Sumatra. Shell interests have proposed the complete reconstruction of three of their prewar installations in Borneo and Sumatra, and plans for a fourth are only awaiting the appraisal of nearby crude reserves.

Special Refinery Considered

"In the Middle East, it was reported just before the war that British interests were making tentative plans for the erection of an entire new refinery in Iran to process the high-sulfur crude from a newly discovered oil field at Gach Saran. Recently it has been reported that two American companies have obtained a 70-year option to build a large refinery at Tripoli, Syria. During the war several companies, of both American and British ownership, were ready and willing to finance the construction of such new refineries in the Middle East as might be necessary to meet the demand for war products in that general area. It has recently been reported in the press that an American company is planning construction of a refinery in Australia to process Middle East crude.

"These preliminary programs and proposals give a general idea of the directions in which refinery expansion may reasonably be expected to develop in the early postwar years."

The short position on gasoline, kerosene and distillates in areas outside the United States supports the conclusion that refining operations in these areas will be maintained at capacity. Foreign refineries, excluding the U.S.S.R. where capacity is around 900,000 bbl. daily, are expected to maintain crude input at approximately 1,948,000 bbl. per day in the second half of 1946 compared with 1,089,000 bbl. in 1942 and 1,831,000 bbl. in the last quarter of 1945.

PRODUCTION of crude oil in foreign countries reached an all-time peak of 1,942,000 bbl. daily at end of 1945, exclusive of U.S.S.R. areas, a rate which was continuing upward despite cessation of military action. The target for foreign production at the end of 1946, if the war had continued, was set at 2,340,000 bbl. per day, a rate which would have called for more substantial increases in the output from Venezuela and the Middle East.

Foreign petroleum production, exclusive of Russian areas, will continue upward to an estimated average of 2,064,000 bbl. daily during the second 6 months of 1946. This forecast, made by the Program Division, Petroleum Administration for War, just before termination of the wartime oil agency, is predicated on the rising requirements for all products in foreign markets. The major increases over the next 12 months are expected to come from the Persian Gulf area which will account for about 66,000 bbl. of the daily increment; the Far East, up 35,000 bbl., and the Caribbean area, up 22,000 bbl.

A further decline of 195,000 bbl. in the United States during the last half of 1946 will more than offset the increased output of foreign oil countries, leaving the world yield of crude with a net decline of approximately 72,000 bbl. daily.

Previously undisclosed foreign petroleum-production data for the war period were read into the Senate oil policy committee record recently by William B. Heroy, director, Foreign Production Division, PAW, who had this to report:

Production Eastern Hemisphere

"While the Eastern Hemisphere has 70 per cent of the world's land surface and 85 per cent of its population, it has fallen far short of producing is share of the world's oil. This is partly because the highly populous and industrialized countries of Western Europe have possessed meagre oil resources, entirely insufficient for their requirements. The fact that the great petroleum resources of the Middle East were owned by nations with very limited economic power and without experience in petroleum development has also been an important influence. In 1938 the oil production of the Eastern Hemisphere was only 24 per cent of the total world production.

"The most important country of the Eastern Hemisphere in oil production is the U.S.S.R. In world production it ranges second to the United States.

"Accurate figures of the production of the U.S.S.R. for the last 5 years have not yet been made available but it is estimated that the production of the U.S.S.R. in 1944 did not exceed 780,000 bbl. daily.

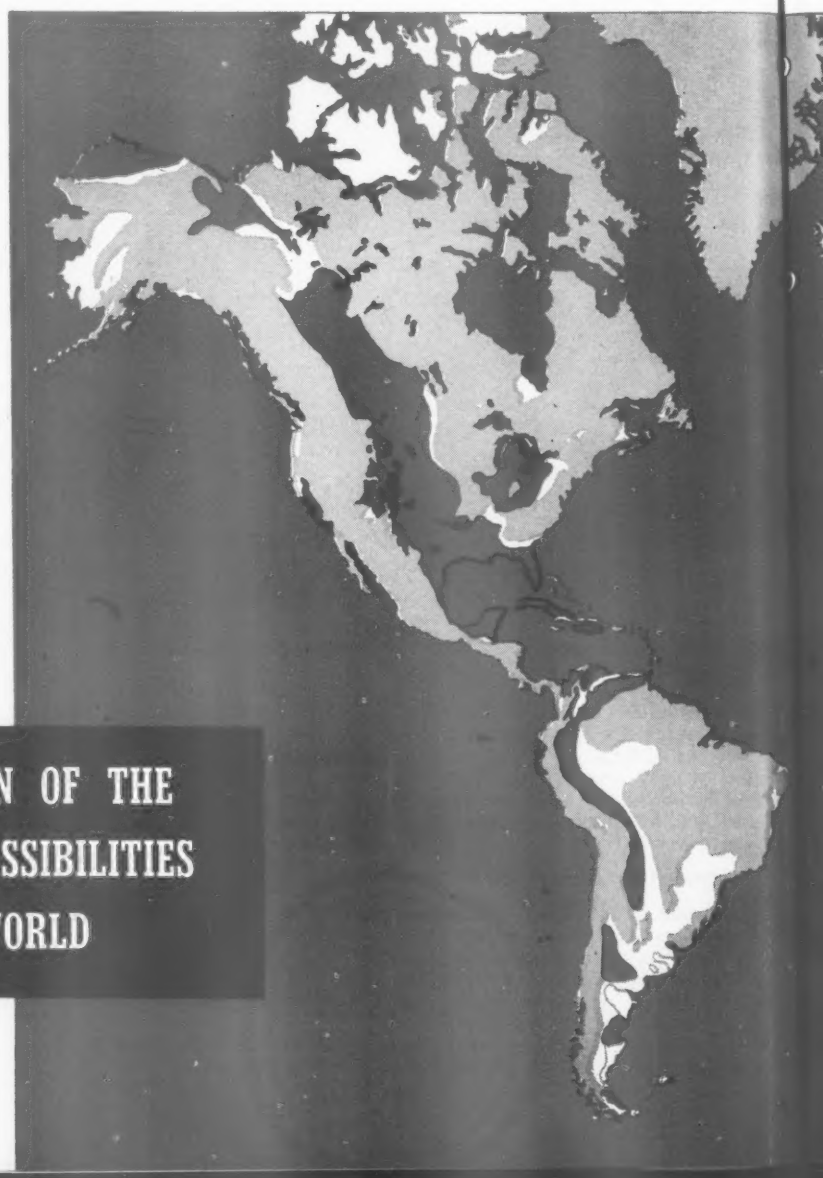
Production—Western Hemisphere

"The Western Hemisphere, excluding the United States, contains about 25 per cent of the earth's land surface and in 1938 produced about 15.5 per cent of the world's oil.

"The most important producing country is Venezuela. Its commercial production dates from 1917 and in 1938 it reached nearly 9 per cent of the world's total. Other countries in South America produced in 1938 less than 4 per cent of the world's total. Mexico's production rose rapidly in the period 1919-1921 and in the latter year reached 25 per cent of the world's total production. It has since declined and in 1938 it was only 2 per cent of the world's total.

Foreign-Production History

"Foreign crude production, excluding U.S.S.R., and the U.S. averaged about 1,400,000 bbl. daily for 1938. After the commencement of the war in Europe the petroleum requirements of Great Britain and her allies in Western Europe brought about a gradual increase in foreign production, which reached a total of about 1,600,000 bbl. daily just prior to the opening of the war in



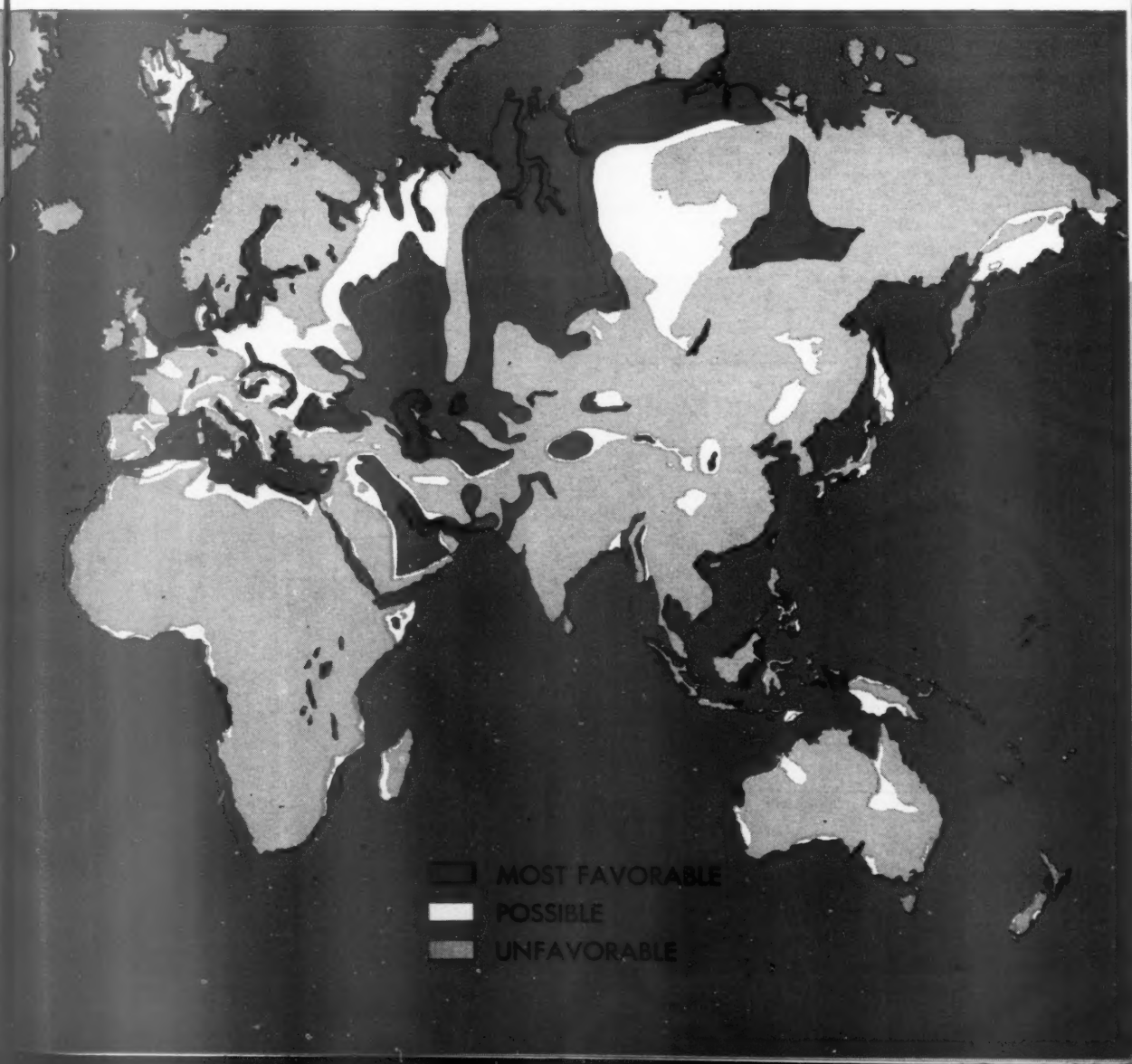
CLASSIFICATION OF THE PETROLEUM POSSIBILITIES OF THE WORLD

the Pacific. The German submarine campaign, with the resulting tanker losses and convoy restrictions, caused a sharp decline in foreign production during the first half of 1942. The conquests of the Japanese in the Far East also deprived the United Nations of important sources of crude petroleum, so that by the middle of 1942 foreign production had declined about 40 per cent from the peak of 1941, and was down to about 1,000,000 bbl. daily. At that time the amount of crude available in both the Caribbean and the Middle East was ample as compared with the capacity of local refineries available for processing it and as compared with the capacity of tankers available for transporting the products.

"The rate of foreign production continued essentially without change until the middle of 1943. By that time, however, it was becoming apparent that requirements for petroleum would thenceforth increase rapidly. Estimates of future military requirements foreshadowed large increases in demand, particularly in the Pacific area, which could not be met from areas adjacent to the Pacific. Surveys were accordingly instituted for the purpose of making the best possible estimate of United Nations future requirements and to determine from what sources the required crude could be obtained. Meanwhile the requirements for foreign crude turned upward and, by the end of 1943, were approximately 1,350,000 bbl. daily.

"The program for 1944, developed in the latter part of 1943, called for a gradual increase in foreign production, reaching 1,575,000 bbl. daily in the last quarter. Most of this increase was required in the Caribbean area and particularly in areas capable of producing light crude to increase gasoline output. The drilling of nearly 700 additional wells was programmed to offset the normal decline of producing fields and to prospect new areas that might be brought into production to meet the requirements of later years. Addational pipe lines and shallow-draft tankers were also required to make the production available. The program was revised upward in the second quarter to call for a production of 1,760,000 bbl. daily in the last quarter of the year but this production was not attained because of a shortage of ocean tankers. The actual foreign production at the end of 1944 was about 1,600,000 bbl. daily, or 160,000 bbl. daily below the program.

"A similar procedure was followed in planning operations for 1945. Surveys in the latter part of 1944 and in the first half of 1945 indicated that foreign production would be required to reach about 2,000,000 bbl. daily by the end of the year. About 1,600 additional wells in foreign countries were programmed to meet these requirements and special action was taken to make drilling



rigs and other equipment available for the purpose.

"The United Nations received during the 3½ years ended June 30, 1945, approximately 1,670,000,000 bbl. of crude petroleum from sources outside the United States and the U.S.S.R. In some areas, particularly in Trinidad and India, this production was obtained at the cost of excessive withdrawals on reserves. In other countries, such as Arabia and Venezuela, new discoveries made during the war period were in excess of the quantities of petroleum produced. On the average, known foreign reserves were drawn upon at the approximate rate of 2 per cent per year while the rate at which known United States reserves were produced was nearly 7½ per cent per year.

"Demands for petroleum during the war have thus fallen more heavily on some countries than others and have left some countries in relatively favorable positions as regards petroleum supplies to meet the requirements of the postwar period.

World Petroleum Reserves

"The total proved petroleum reserves of the world are approximately 50 billion barrels.

"The figures given are for proved reserves only. Proved reserves are those quantities of petroleum present in underground reservoirs whose presence has been demonstrated by the drilling of wells which have penetrated such reservoirs and whose volume has been calculated by engineering methods of appraisal. Proved reserves do not include such undiscovered petroleum as may, on the basis of geological or geophysical information, be considered to be prospectively present in untested portions of geological structures, in deeper but untested reservoirs, in structures whose possibilities have not as yet been tested by drilling, or in areas that for various reasons are considered favorable for the occurrence of petroleum.

"The estimates shown are as of January 1, 1944. Additional reserves of importance have been discovered in a few countries since 1944 but it has not been feasible to revise the figures to reflect these changes. The addition of such recently discovered reserves would not essentially alter the proportionate distribution shown

ESTIMATED POSTWAR REFINERY CRUDE RUNS IN COMPARISON WITH WARTIME RUNS*

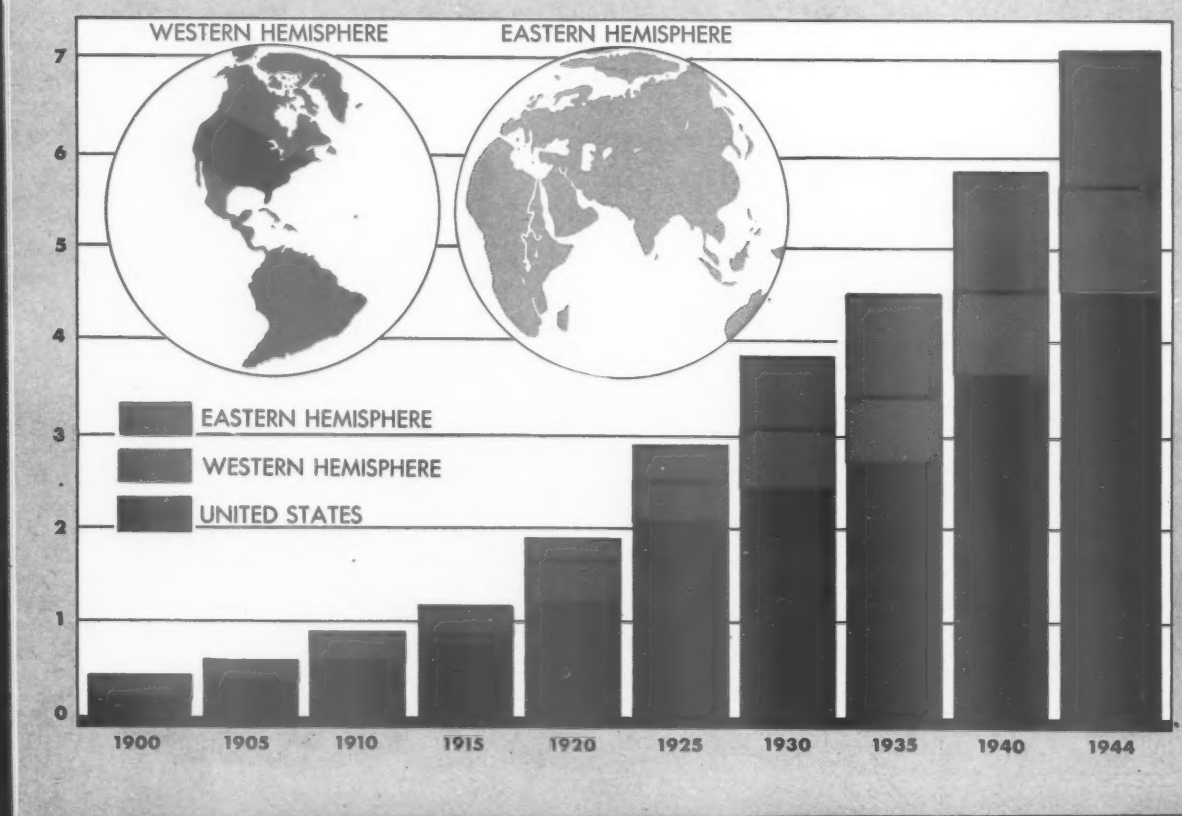
(Worldwide, exclusive Russian Areas)
(Thousands of Barrels Daily)

	Actual			Estimated				
	Year 1942	Year 1943	Year 1944	3rd Q. 1945	4th Q. 1945	1st Q. 1946	2nd Q. 1946	2nd half 1946
United States	3,654	3,916	4,551	4,774	4,530	4,105	4,230	4,230
Caribbean (1)	401	500	626	764	732	744	744	735
Near and Middle East—								
Eastern Med. (2)	83	104	119	121	116	119	119	119
Persian Gulf Area and India (3)	254	260	330	437	479	506	506	506
Other Areas—								
Canada	149	162	179	207	165	134	181	178
Mexico	82	90	94	100	109	113	113	113
Other Latin Amer. (4)	119	119	118	117	126	126	126	110
U. K. & West. Europe	1	3	3	3	59	104	104	104
Far East	....	....	....	....	45	58	68	83
Grand total	4,743	5,154	6,020	6,523	6,361	6,009	6,191	6,178

(1) Includes NWI, Trinidad, Venezuela, and Colombia. (2) Includes Palestine, Syria, Iraq, Egypt. (3) Includes Iran, Bahrein, Saudi-Arabia, India. (4) Includes Peru, Argentina, Uruguay, Ecuador, Cuba, Brazil, and Bolivia. *Wartime runs exclude Axis controlled areas. Data from PAW Program Division.

WORLD CRUDE-OIL PRODUCTION

(Million Barrels Daily)



by the chart. Any such changes, however, would tend to increase the proved reserves of the Caribbean area and of the Middle East. The proved reserves of the United States would be essentially unchanged while those of the U.S.S.R. have probably decreased during the last 2 years.

World Petroleum Resources

"The distribution of petroleum resources throughout the world is quite irregular and unequal, some countries having great petroleum resources while other countries have little if any petroleum within their national domain. Furthermore, there are great differences among countries as to the extent to which their petroleum resources have been developed and utilized. In some countries, Mexico and Romania, for example, the petroleum resources originally present have been greatly depleted, past production greatly exceeding present proved reserves. The petroleum resources of the United States, for reasons heretofore indicated, have been rapidly developed, and cumulative production to date substantially exceeds present known reserves. Other important producing countries, such as Venezuela and Iran, have proved reserves greatly in excess of their past production.

"The most direct measure of the extent to which petroleum resources have been developed is the number of wells drilled and in production. The petroleum resources of the United States have been developed by the drilling of about 1,100,000 wells. At the beginning of the present year about 408,000 wells were producing with an average production of about 12 bbl. per day per well. The average remaining proved reserve is about 54,000 bbl. per producing well. Venezuela has been de-

ESTIMATED POSTWAR PETROLEUM PRODUCTION IN COMPARISON WITH WARTIME PRODUCTION*

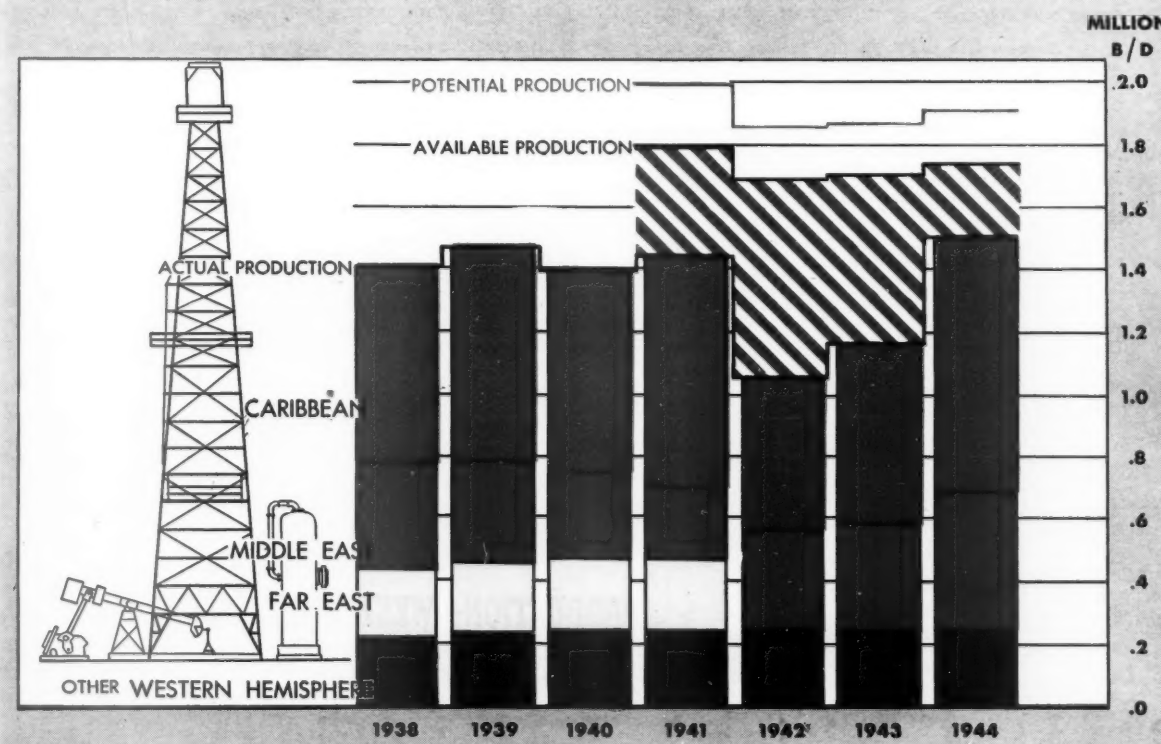
(Worldwide, exclusive Russian areas)
(Thousands of Barrels Daily)

	Actual			Estimated			
	Year	Year	Year	4th Q.	1st Q.	2nd Q.	2nd half
Crude oil—	1942	1943	1944	1945	1946	1946	1946
United States	3,795	4,117	4,583	4,390	4,115	4,220	4,195
Caribbean Area (1)	494	584	822	1,026	1,022	1,066	1,048
Near & Middle East—							
Eastern Med. (2)	73	99	113	123	123	123	123
Pers. Gulf Area and India (3)	246	241	329	489	545	555	555
Other Areas—							
Canada	28	26	23	22	22	22	22
Mexico	96	96	104	114	118	118	118
Other Latin America (4)	112	116	115	111	111	111	106
U. K. & Western Europe	....	2	2	17	17	17	17
Far East	....	....	....	40	50	60	75
Total crude oil	4,844	5,281	6,091	6,332	6,123	6,292	6,259
Other Raw Material (5)—							
United States	231	249	282	320	300	300	300
Foreign	29	26	28	36	35	35	35
Total other raw material	260	275	310	356	335	335	335
Total petroleum	5,104	5,556	6,401	6,688	6,458	6,627	6,594

(1) Includes Venezuela, Colombia, and Trinidad. (2) Includes Iraq and Egypt. (3) Includes Iran, Saudi-Arabia, Bahrein, Kuwait, and India. (4) Includes Peru, Argentina, Ecuador, Bolivia, and Brazil. (5) Includes Natural Gasoline, Benzol, Alcohol, Shale Oil, and Synthetics. *Wartime production excludes Axis controlled areas. Data from PAW Program Division.

INCREASE IN AVAILABLE FOREIGN PRODUCTION

United Nations (Excluding U.S.S.R. & U.S.) and Neutrals



PRODUCTION—EASTERN HEMISPHERE

(Million Barrels Daily)

WORLD-WIDE PETROLEUM PRODUCTION, EXCLUSIVE OF RUSSIAN AND AXIS CONTROLLED AREAS

(Thousands of Barrels Daily)

	1942	1943					1944					1945		
Crude oil—	Av. Year	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Av. Year	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Av. Year	1st Qtr.	2nd Qtr.	Av. 1st 6 Mos.
United States	3,795	3,858	3,980	4,223	4,406	4,117	4,411	4,529	4,669	4,724	4,583	4,769	4,842	4,806
Caribbean Area—														
Venezuela	405	390	427	549	587	489	566	681	804	757	702	771	849	810
Colombia	29	11	26	47	58	36	53	65	65	60	61	52	63	57
Trinidad	60	60	59	57	58	59	59	60	59	58	59	59	58	59
Total Caribbean Area	494	461	512	653	703	584	678	806	928	875	822	882	970	926
Near and Middle East—														
E. Mediterranean[1]	73	82	101	104	108	99	106	104	116	124	113	119	123	121
Pers. Gulf Area and India[2]	246	257	223	208	276	241	322	305	326	362	329	379	392	385
Total Near and Mid. East	319	339	324	312	384	340	428	409	442	486	442	498	515	506
Other Areas—														
Canada	28	26	26	26	25	26	23	23	23	23	23	23	23	23
Mexico	96	83	90	103	109	96	109	95	107	106	104	109	123	116
Argentina	65	68	68	67	68	68	66	68	67	67	67	66	63	64
Bolivia	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ecuador	6	7	6	7	6	7	7	9	8	8	8	7	7	7
Peru	40	40	40	40	40	40	39	39	40	38	39	38	38	38
United Kingdom	..	2	2	2	2	2	2	2	2	2	2	2	2	2
Total other areas	236	227	233	246	251	240	247	237	248	245	244	246	257	251
Total crude oil	4,844	4,885	5,049	5,434	5,744	5,281	5,764	5,981	6,287	6,330	6,091	6,395	6,584	6,489
Other raw material—														
United States	231	242	243	248	261	249	265	274	285	304	282	318	318	318
Foreign areas	29	24	28	25	27	25	31	28	25	27	28	27	24	25
Total other raw material	260	266	271	273	288	275	296	302	310	331	310	345	342	343
Grand total petroleum	5,104	5,151	5,320	5,707	6,032	5,556	6,060	6,283	6,597	6,661	6,401	6,740	6,926	6,832

(1) Includes Iraq and Egypt. (2) Includes Iran, Bahrein Is., Saudi-Arabia, and India. (3) Includes natural gasoline, benzol, alcohol, and United Kingdom synthetic and shale oils. Compiled from data prepared by Foreign Production Division, PAW.

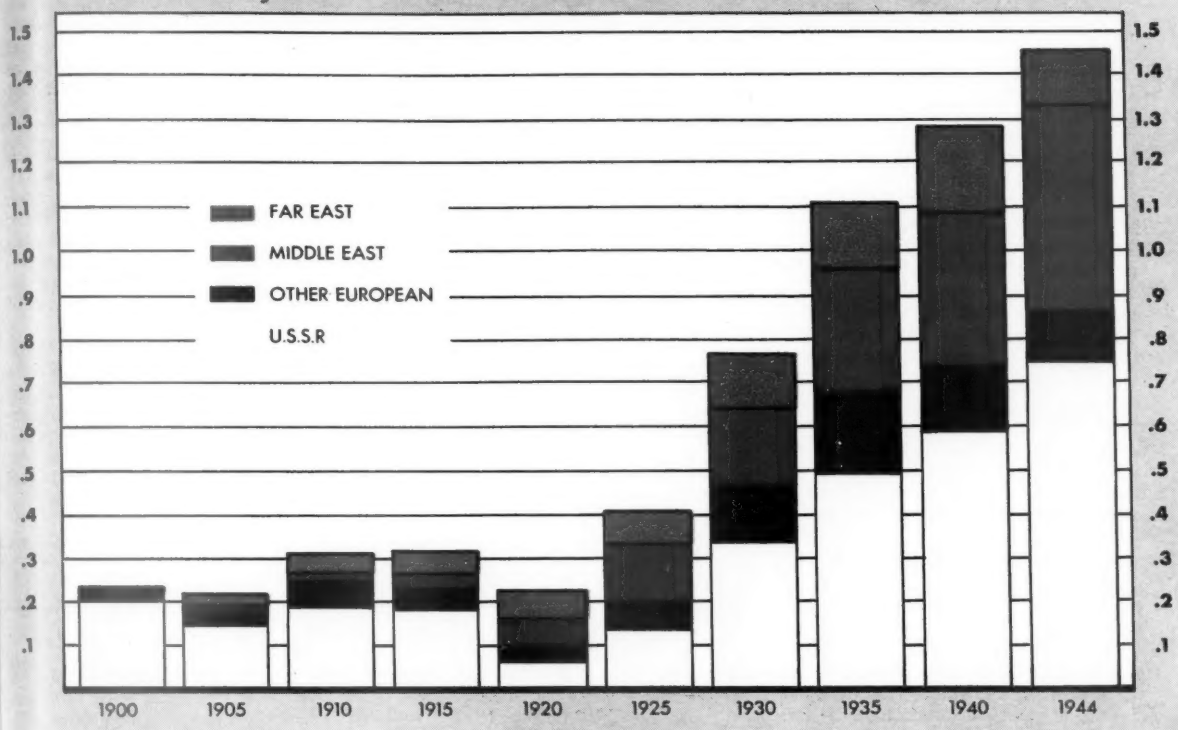
veloped by the drilling of about 6,700 wells, of which about 4,200 are producing with an average daily production of 206 bbl. per well. The proved reserve per producing well is about 1,700,000 bbl. In the four producing countries of the Persian Gulf area there are now about 160 producing wells and the proved reserves are about 93,000,000 bbl. per well. At the beginning of 1940 the U.S.S.R. had about 13,000 producing oil wells with an average daily production of 45 bbl. per well. Proved reserves were about 450,000 bbl. per well.

"American interests not only control nearly all of the proved reserves of the United States, comprising about 39 per cent of the world total, but also have large interests in the petroleum reserves of other countries, comprising an additional 19 per cent. The American participation in the world total is accordingly 58 per cent. The principal foreign holdings of the United States are in the Caribbean area and in the countries bordering on the Persian Gulf.

"British interests control most of the proved reserves of the countries withing the British Empire, amounting to 1.3 per cent of the world total. But British capital controls large reserves in other countries, especially in the Middle East,

PRODUCTION—WESTERN HEMISPHERE

(Million Barrels Daily)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FAR EAST
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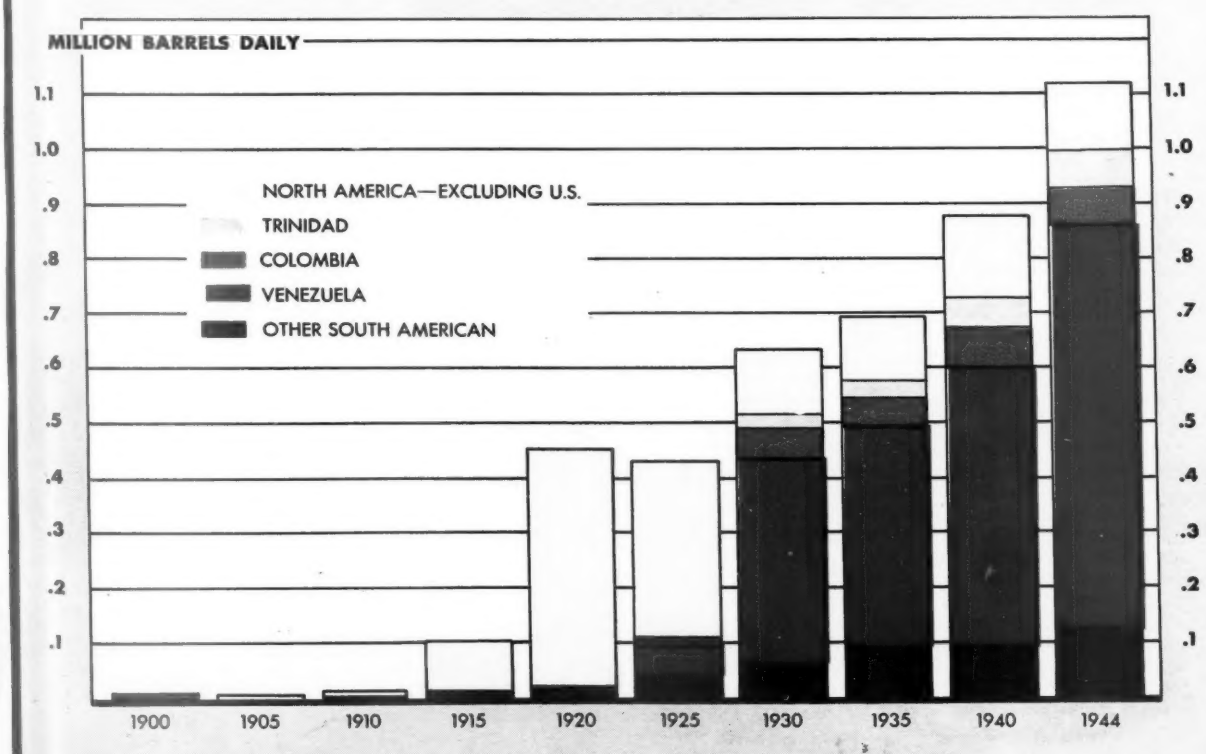
MILLION BARRELS DAILY
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NORTH AMERICA—EXCLUDING U.S.
TRINIDAD
COLOMBIA
VENEZUELA
OTHER SOUTH AMERICAN
1900
1905
1910
1915
1920
1925
1930
1935
1940
1944

which represent over 20 per cent of the world total. The total share of the world's reserves controlled by British interests is about 22 per cent.

"Netherlands interests, largely in business partnership with British interests, control an additional 5 per cent of the world's proved reserves, of which about half are in the East Indies. The British-Dutch combined interests therefore total about 27 per cent.

"The participation of the U.S.S.R. is estimated at 11 per cent. If the reserves of the countries in Eastern Europe which are now occupied by the Russian armies are added, the total under Russian control is about 12 per cent."

Foreign crude-oil production next year is expected to remain about 1 million barrels per day above the 1942 rate and will increase about 150,000 bbl. daily above the maximum wartime level which was registered in August 1945.

Projections of foreign crude production are predicated on assumed conditions of imports by the United States, Canada, the United Kingdom, France and other miscellaneous markets. The estimated market for crude oil in western Europe, of course, is entirely dependent on the rapidity with which refining facilities are restored to operating condition. The petroleum industry's plans in Europe cannot take final shape until political conditions are clarified. Furthermore, the market for refinery products will be strictly limited until economic and general industrial conditions make more substantial progress in returning to normal.

It is assumed by most qualified observers that Caribbean crude oil will move chiefly to the United States, the United Kingdom, France, the Canary Islands, Uruguay, Brazil, and the Argentine. Westward movement through the Panama Canal, an outlet which was developed extensively to meet exigencies of war, will not continue during peacetime. At least, there will be no continuing call for Caribbean crude in the Pacific because of plans to restore the Netherlands East Indian fields to prewar operating levels.

Demand for crude oil to meet Australia's requirements will be satisfied as rapidly as Dutch East Indian fields can be restored from that source. Refineries in Australia were shutdown during most of the war and the country's oil-fuel requirements were supplied in the form of finished products. Here, as in other parts of the world, refinery equipment must be rehabilitated and the newer, more efficient processes installed in order to meet postwar competitive conditions.

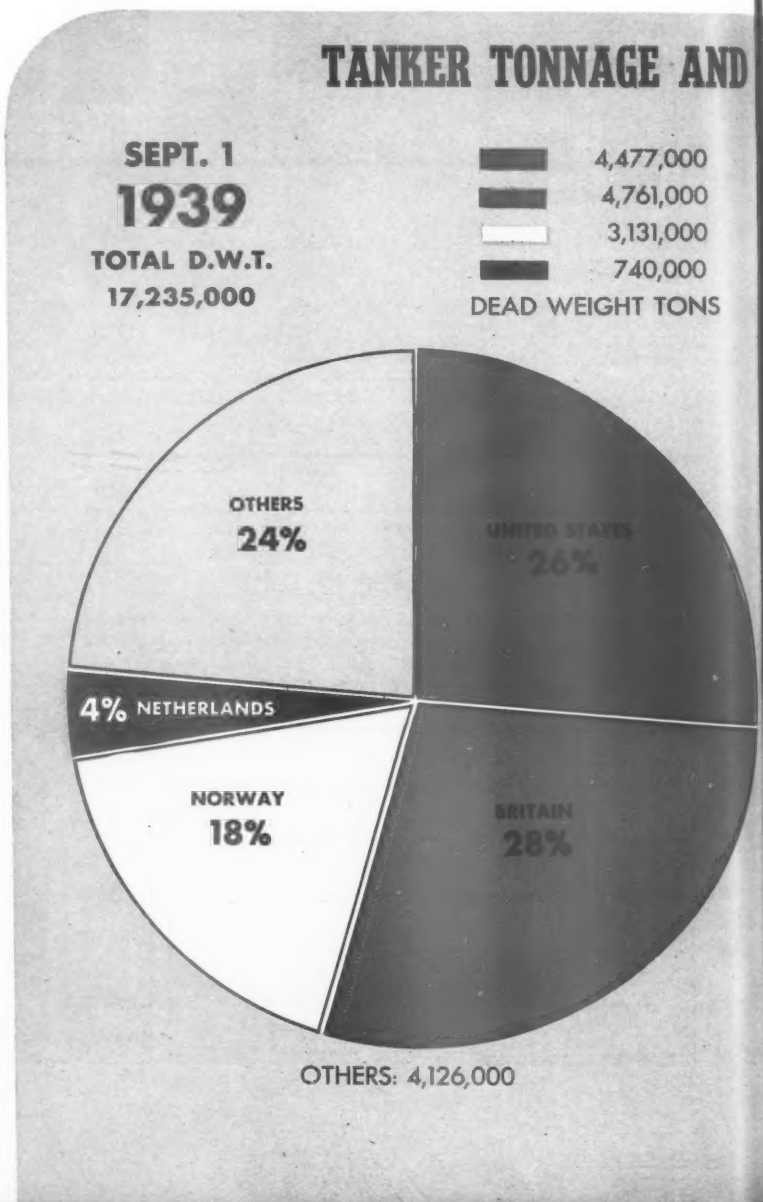
TRANSPORTATION, of course, is one of the most important aspects of world-wide petroleum operations. Extensive pipe-line construction plans in the Middle East, Latin America, and the Far East are detailed in other reports in this issue.

All of the large producing and refining centers outside the United States, however, are essentially dependent on ocean-going tankers to transport crude and refinery products to foreign markets. It is pertinent, therefore, to consider the world's supply and demand for tankers. The postwar surplus of tankers, it seems obvious, is more than adequate to cope with the over-all increases indicated for foreign crude-oil production and refinery operations.

With restoration of peace, it is probable that means will be developed to reduce the surplus of tankers under the United States' flag. War sinkings were particularly severe in the British fleet. Great Britain incurred 34.7 per cent of the total tank-ship capacity lost during the war, and new construction amounted only to 10.6 per cent of new vessels built. The Norwegian fleet was severely reduced by war sinkings, suffering 16.9 per cent of the total war losses.

The United States' tanker fleet of 907 vessels on September 1, 1945, is nearly two and a half times larger than Great Britain which is second in world importance with 399 tank ships. In deadweight tonnage, the United States' tanker fleet is approximately three times greater than the British oil vessels.

In satisfying transportation requirements during the war, the United Nations constructed the equivalent of 821 T2-SE-A1 oil tankers and 82 per cent, or the equivalent of 673 T2's from 1940 to September 1, 1945. In a report on world tanker operations copyrighted by



T2-SE-A1 EQUIVALENT BALANCE SHEET OF WORLD TANK SHIP FLEET SEPTEMBER 1, 1945, BASED ON SEPTEMBER 1, 1939, REQUIREMENTS

(Ocean-Going Vessels of 2,000 Gross Tons and Over)

Item—	U. S. fleet		All other fleets		Total world fleet	
	Number	D.W.T.	Number	D.W.T.	Number	D.W.T.
Fleet—9/1/39	185.3	3,106,600	590.3	9,896,400	775.6	13,003,000
Fleet—9/1/45	756.2	12,677,700	508.3	8,521,700	1,264.5	21,199,400
Surplus or deficiency	+570.9	+9,571,100	—82.0	—1,374,700	+488.9	+8,196,400
Vessels 20 years and over	91.8	1,539,000	92.5	1,550,800	184.3	3,089,800
Net surplus or deficiency	+479.1	+8,032,100	—174.5	—2,925,500	+304.6	+5,106,600
Indicated market based on 9/1/39 requirements	91.8	1,539,000	174.5	2,925,500	266.3	4,464,500

Data from Sun Shipbuilding & Dry Dock Co. report.

Sun Shipbuilding & Dry Dock Co., Benedict Saurino, the author, concludes:

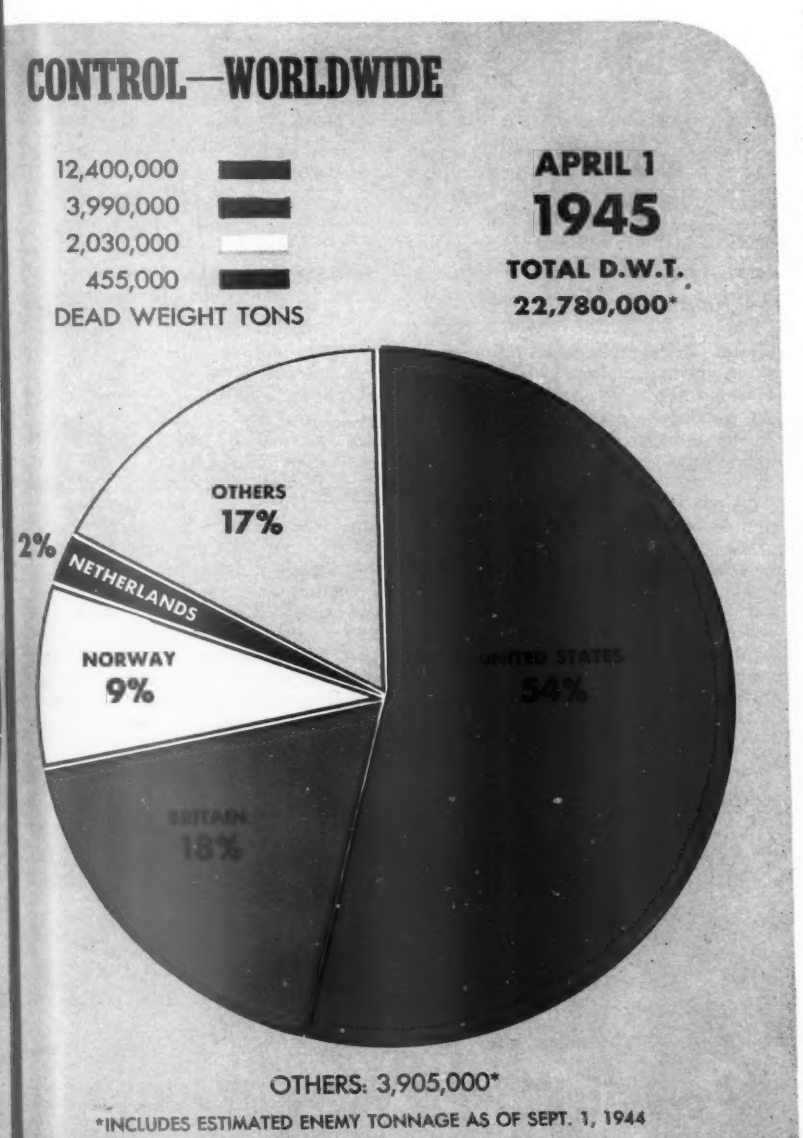
"It is found that the United States fleet emerged from the war with a capacity greater by 570.9 T2's than it had on September 1, 1939, while the balance of the world showed a deficit of 82.0 T2's for a net world surplus of 488.9 vessels of the T2 type. When vessels 20 years of age and over are eliminated from this world surplus the net becomes 304.6 T2 equivalents on September 1, 1945. From these calculations it is noted that based upon the September 1, 1939, requirements there is indicated a world-wide market for 266.3 T2's, leaving a net surplus of 304.6 T2 equivalents.

"The world fleet on September 1, 1939, consisted of 775.6 T-2 equivalents with the United States having 185.3 of these vessels or 23.9 per cent of the world. On September 1, 1945, the world tank ship fleet had increased to 1,264.5 T-2 equivalents with the United States owning 756.2 or 59.8 per cent of the total world. The current fleet is approximately four times that which existed on September 1, 1939. The most significant decreases occurred in the Norwegian and the Netherlands fleets with the former now having 70 per cent of its prewar capacity and the latter, 60.5 per cent. The high construction rate in Britain and Canada during the war has resulted in a current fleet under the British flag amounting to 87.2 per cent of its prewar capacity.

"An analysis of the deadweight tonnage distribution contained in the world tank ship fleet indicates that of its entire fleet the United States has only 22 per cent of its vessels smaller than 16,000 deadweight tons, while the rest of the world has 88.3 per cent of its tonnage below that deadweight group. The United States Maritime Commission construction program emphasizing the T2-SE-A1 type of vessel accounts for this lopsided distribution in the American fleet. For this same reason the analysis of speed distribution indicates that only 22.1 per cent of the United States fleet is slower than 14 knots, while the balance of tank ships in the world have 84.2 per cent of their number in the speed groups slower than 14 knots.

"In analyzing the age distribution of tank ships in the world it is found that vessels 20 years and over amount to 2,130,514 deadweight tons in the United States' fleet and 2,197,235 deadweight tons in all other fleets for a total world over-age tonnage of 4,327,749 deadweight. Converting these tonnages to T-2 capacity they represent 91.8 vessels of the United States fleet which are 20 years and older. 92.5 for all other fleets, or a total of 184.3 T-2 equivalents which have been fully depreciated. The average age of the total United States fleet is 6 years and 1 month while that of vessels under 20 years old averages 2 years and 4 months.

"It is found that 25.5 per cent of the total world capacity is owned by oil companies, 18.8 by nonoil and 55.7 by governments. Eliminating all government ownership, it is found that oil companies own 57.6 per cent of the remaining tonnage capacity in the world. The U. S. Government under its own and all other registries owns 46 per cent of the total world tonnage while the United States oil companies and their subsidiaries own and operate 18.3 per cent of the world tonnage. Of all the tank ships owned by petroleum companies in the world, the United States organizations and their subsidiaries own and control 71.8 per cent while their tonnage



WORLD TANK SHIP FLEET BY FLAG ON SEPTEMBER 1, 1945

(Ocean-Going Vessels of 2,000 Gross Tons and Over)

Flag—	Number	Gross tonnage	Deadweight tonnage	Average weighted by D.W.T. of: Speed (knots)	Age Yrs.	Age Mos.	Vessels 20 years and over: No.	Vessels 20 years and over: D.W.T.	Vessels under 20 years: No.	Vessels under 20 years: D.W.T.	Avg. age Yrs.	Avg. age Mos.
Western Hemisphere—												
United States	907	8,379,542	13,379,143	13.74	6	1	215	2,130,514	692	11,248,629	2	4
Panama	72	522,607	819,890	11.09	17	5	33	339,943	39	479,947	10	4
Others:												
Argentina	24	152,034	211,218	11.36	20	2	14	109,458	10	101,760	12	5
Brazil	6	33,763	50,558	9.89	26	4	6	50,558	....	.....	..	..
Chile	2	7,586	9,662	11.00	17	4	...	.....	2	9,662	17	4
Honduras	1	7,623	11,135	12.00	6	2	...	.....	1	11,135	6	2
Mexico	10	60,458	93,289	10.63	22	5	6	52,219	4	41,070	14	4
Peru	1	2,820	4,300	10 00	24	2	1	4,300	....	.....	..	..
Philippines	1	5,212	9,112	12.50	7	2	...	.....	1	9,112	7	2
Uruguay	1	6,599	10,700	11.50	25	2	1	10,700	....	.....	..	..
Venezuela	22	63,483	87,100	9.97	19	2	2	15,500	20	71,600	16	11
Sub-total "Others"	68	339,578	487,074	10.84	20	8	30	242,735	38	244,339	13	9
Total West. Hemisphere (Excl. Canada & Incl. Philippines)	1,047	9,241,727	14,686,107	13.50	7	2	278	2,713,192	769	11,972,915	2	11
Europe—												
Great Britain	399	2,800,789	4,090,209	11.34	11	7	100	847,208	299	3,243,001	7	5
Norway	165	1,393,138	2,115,271	12.14	11	5	18	176,702	147	1,938,569	9	11
Netherlands	65	322,954	451,266	11.03	11	4	16	57,577	49	393,689	9	7
France	15	109,241	162,106	11.42	14	8	4	35,796	11	126,310	11	10
U. S. S. R.	22	161,356	246,411	12.11	10	2	4	30,820	8	215,591	7	4
Germany	40	332,741	488,723	12.20	12	3	4	42,710	36	446,013	10	6
Italy	22	126,591	179,123	10.45	24	9	16	118,299	6	60,824	11	0
Sweden	37	325,113	495,234	12.98	7	1	1	8,300	36	486,934	6	10
Others:												
Belgium	4	28,641	41,835	11.31	16	2	1	10,375	3	31,460	12	6
Denmark	4	40,140	60,410	12.74	3	7	...	.....	4	60,410	3	7
Finland	....	.....	.....	....	..	..	....	.....	....	.....	..	..
Greece	4	18,089	27,324	9.90	31	1	3	18,050	1	9,274	18	2
Portugal	2	8,542	13,023	10.88	18	11	1	7,323	1	5,700	3	2
Romania	....	.....	.....	....	..	..	....	.....	....	.....	..	..
Spain	20	108,645	150,844	11.15	16	11	8	50,040	12	100,804	12	2
Turkey	1	6,134	9,000	14.00	7	2	...	.....	1	9,000	7	2
Yugoslavia	1	3,177	3,300	10.00	6	2	...	.....	1	3,300	6	2
Sub-total "Others"	36	213,368	305,736	11.43	15	2	13	85,788	23	219,948	9	7
Total Europe	801	5,785,291	8,534,079	11.68	11	9	176	1,403,200	625	7,130,879	8	6
Japan	63	478,987	696,133	13.73	15	1	21	211,357	42	484,776	10	9
Total world fleet	1,911	15,506,005	23,916,319	12.85	9	0	475	4,327,749	1,436	19,588,570	5	2

Data from Sun Shipbuilding & Dry Dock Co. report.

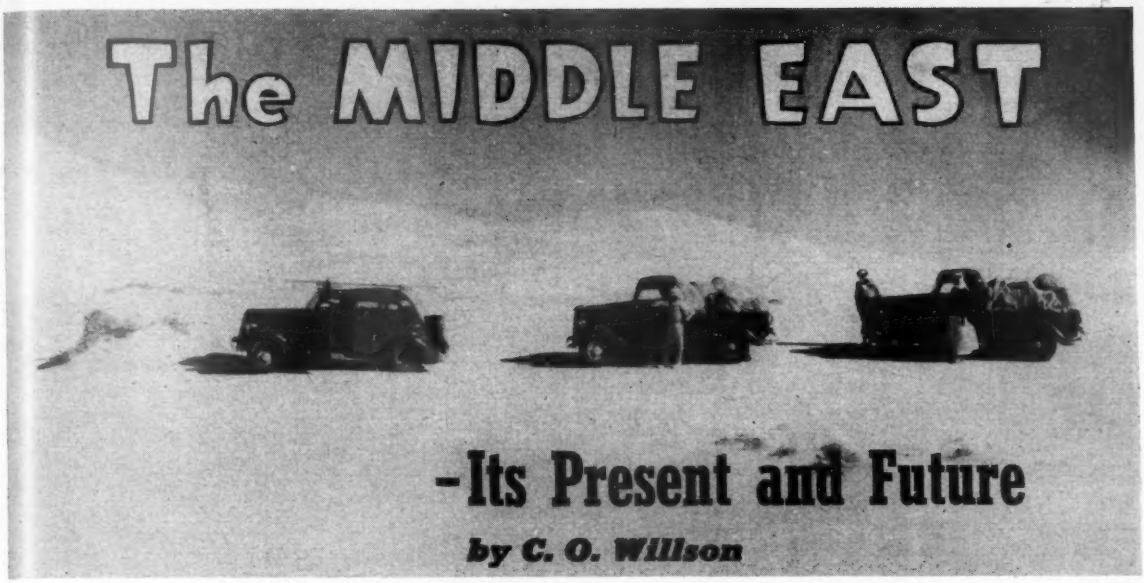
also represents 41.4 per cent of the nongovernment capacity of the world.

"The dominant role played by the United States in tank ship construction during the war years is brought out by the fact that this country constructed 82 per cent of the world tonnage during this period or the equivalent of 673.4 T-2's which was approximately three times the capacity of tonnages delivered by United States yards during the period 1900 to 1939, inclusive. The tankers constructed by the United States during this war were equal to 87 per cent of the world tank ship capacity on September 1, 1939. Great Britain's construction program was equivalent to 10.6 per cent of the total tank ships built during the war and amounted to more than 30 per cent of its construction during the past 4 decades.

Charts appearing in this multicolor section are adapted from originals prepared by the Graphic Division, Petroleum Administration for War. World-wide operations during the war and the probable trends depicted herein constitute the basic information from which will be formed the United States' national and international petroleum policy in the postwar era.

"In the matter of losses, both war and marine, it is noted that Great Britain suffered 34.7 per cent of the total tank ship capacity lost during the war period, the United States losses were 21.0 per cent of the total. The Allied Nations in the aggregate accounted for 87.7 per cent of the total war losses which represented 39.4 per cent of their new construction during this same period. It is of further interest to note that the equivalent of 352.6 T-2's were lost during this war compared with 112.9 T-2 equivalents sunk and scrapped during the first 40 years of this century or a ratio of better than three-to-one."

The MIDDLE EAST



-Its Present and Future

by C. O. Willson

Arabian American Oil Co. geological field party on the move

In this article the Journal's editor gives a summary of Middle East oil operations with a discussion of economic and political conditions which will have a bearing on immediate and long-range operations. The author in October completed a several-month trip in which he visited every major field and refinery in the Middle East and interviewed governmental officials in several of the capitals of that area. In returning to the United States he visited offices of several operating companies in London and Paris.

THAT part of the petroleum world commonly known as the "Middle East" is actually a part of the Middle East and the Near East extending from the Eastern Mediterranean to the Persian Gulf and from the western part of Egypt to the eastern boundary of Iran. Because its oil reserves are unimportant and its operating methods are not typical Egypt is not included in many Middle East oil surveys. In regard to the future it is certain that as postwar programs are made effective the Middle East oil area will be extended in several directions.

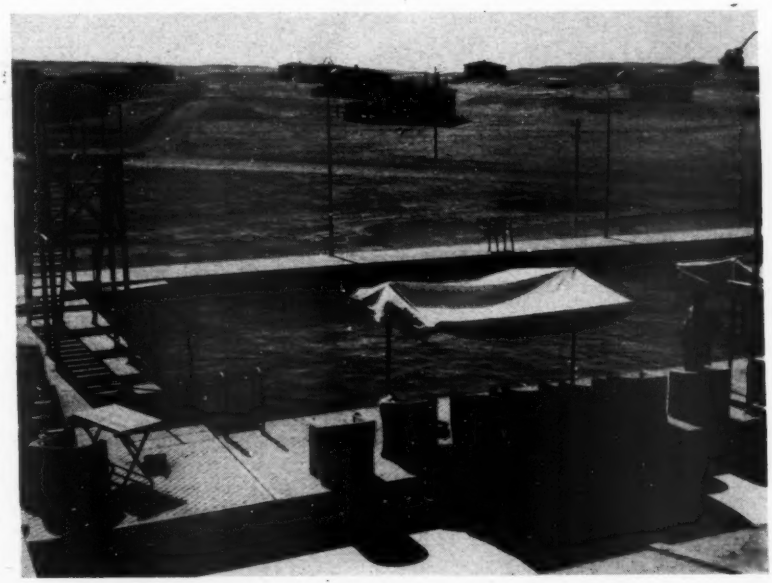
The following table gives the estimated areas and population of the countries which are now considered part of the Middle East oil development shown on accompanying map:

Country—	Area (sq. miles)	Population
Iran	628,000	15,000,000
Iraq	140,000	5,000,000
Syria	54,000	3,000,000
Lebanon	3,600	600,000
Palestine	11,000	1,600,000
Transjordan	35,000	300,000
Arabia*	1,000,000	15,000,000
Ethiopia	350,000	12,000,000
Egypt†	383,000	16,000,000
Total	2,575,000	78,500,000

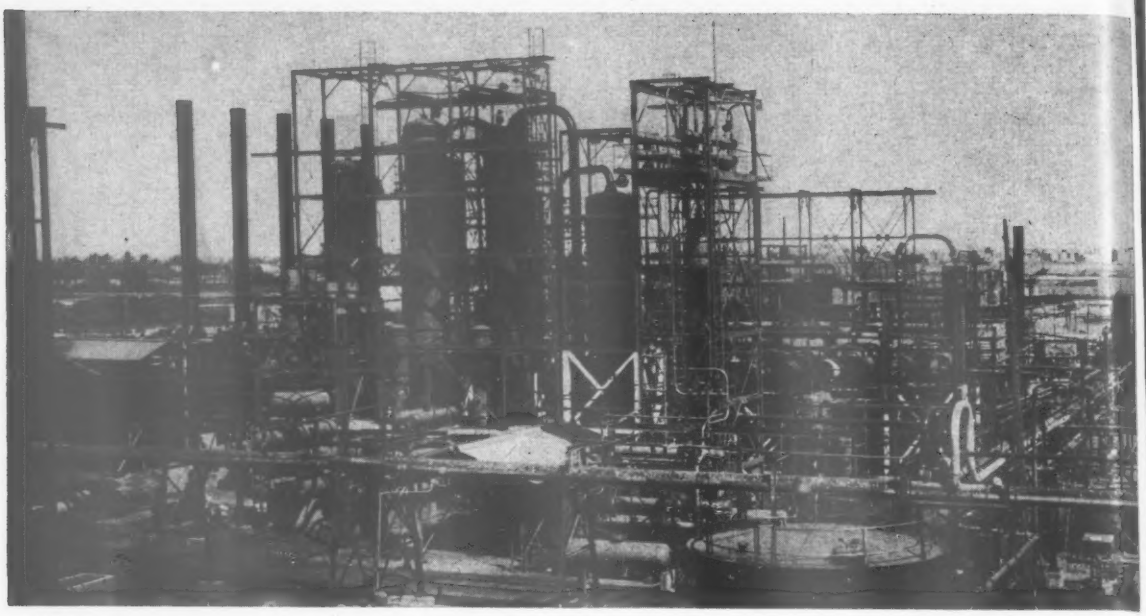
*Includes Saudi Arabia and the dependencies and sheikdoms along the coasts of Red Sea, Alden Gulf, Arabian Sea, Gulf of Oman and Persian Gulf. †Does not include Sudan.

This area is approximately equal to 75 per cent of the land area of the United States and 60 per cent of its population. This part of the world encompasses a large part of the beginnings of recorded time. Archaeologists trace early civilizations back to 4,000 B.C. Many of the social customs and economic practices of the peoples of this area predate the Christian era.

The climate is generally classified as subtropical. In the coastal sections the temperatures range from 40° F. in winter to temperatures as high as 125° F. in summer. The humidity is high particularly in the Persian Gulf area. In the areas of greater altitude high temperatures prevail in summer with temperatures below freezing in winter. The recommended time for visiting the area is from November 15 to April 15. Some of the world-famous winter resorts are located in the area.

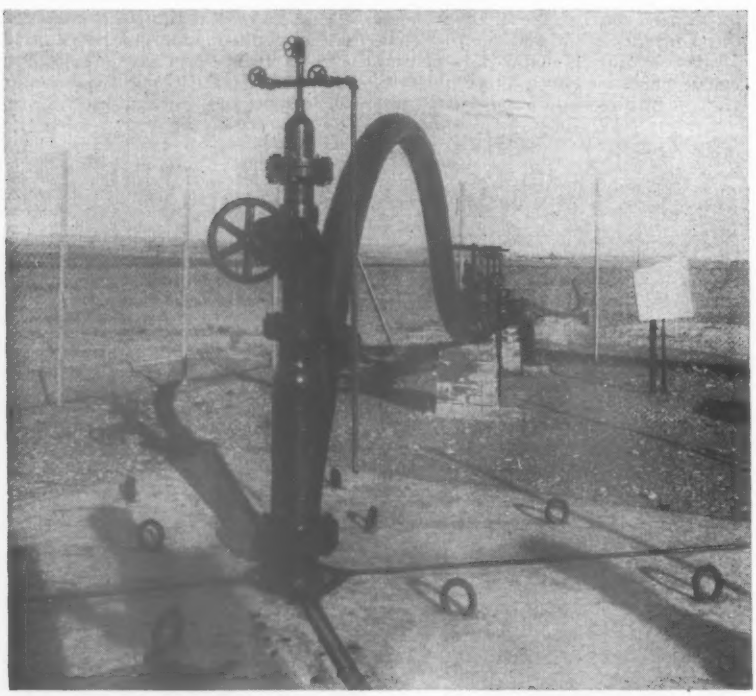


The New Club Colony, in Ras Gharib field, Egypt, with swimming pool in foreground



The Anglo-Egyptian Oilfields, Ltd., refinery at Suez, showing distillation units, looking from west to east. A glimpse of Suez town is seen in right background

More than 90 per cent of the Middle East consists of desert, semiarid and mountainous country. Heavy rainfall is confined to the coastal areas over part of the year. Agricultural pursuits are largely confined to the river valleys and coastal sections. Satisfactory results have been obtained from irrigation projects—notably the Nile Valley—and mammoth plans have been outlined for the future by those seeking the rehabilitation of this section of the world, most of which has shown little economic progress over a period of several centuries. Climatic and soil conditions are sufficiently varied to assure a limited production of many agricultural products including fruits.



Connection of flowing well in Kirkuk field of Iraq

Reflecting in part basic conditions in agricultural and other natural resources the great bulk of the population of the Middle East live a marginal existence. It has been characterized by many writers as an area in which the extremes in standard of living prevail—a large population not far removed from extreme poverty, a small wealthy population, and no middle class.

The foregoing conditions are outlined here because they have a bearing on present and future oil operations. They have meant in effect that except for a few population centers such as Cairo, Egypt, and Haifa, Palestine, that operating oil companies have had to supply all the living facilities for American and British operating staffs as well as thousands of nationals. The standards of living among the nationals generally have also had a bearing on political trends in the past and no doubt these conditions will have increased importance in the future with direct significance in future oil development.

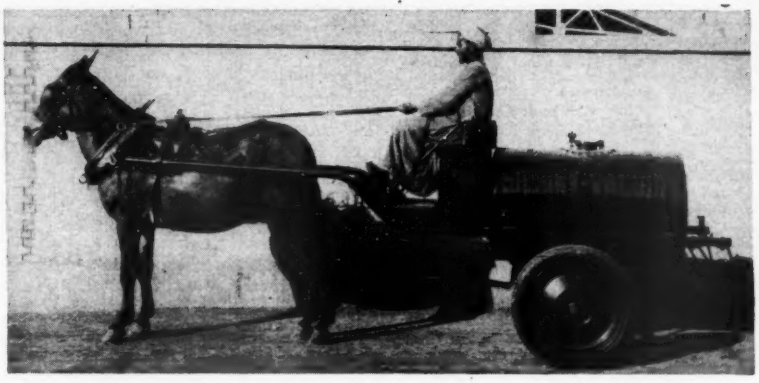
The larger countries of the Middle East are recognized as independent kingdoms. During the war, Lebanon and Syria became independent of French mandate controls and are establishing republican forms of governments. Palestine and Transjordan are British mandated countries. In the Persian Gulf and Arabian Sea areas there are independent sheikdoms with which the British Government has treaty rights. The entire Middle East in the past has been considered within the British sphere of influence and most of the area during the war became part of the sterling-bloc

group which has meant that trading with other countries was subject to British controls.

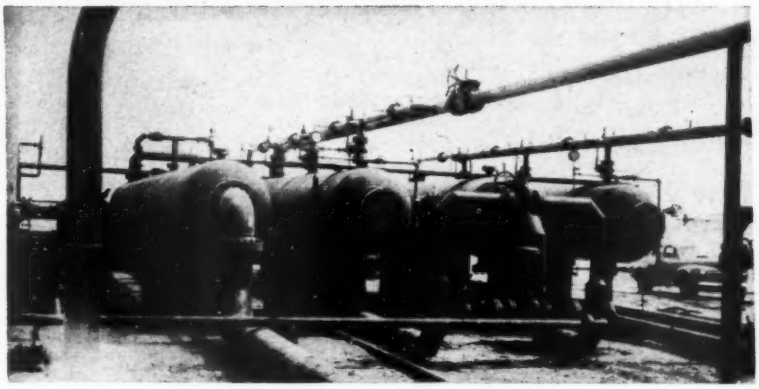
Transportation

It is anticipated that within a few months the transportation accommodations for passengers and freight to the Middle East from Europe and the United States will be on a more extensive scale than ever before. Particular attention will be paid to airplane transportation. It is stated that T.W.A. will have a service calling for 20 hours' flying time between New York and Cairo, Egypt, with a stopover connection in Paris. It is understood that the same company will have a regular flying service between Cairo and Dhahran, the field headquarters of the oil operation in Saudi Arabia. British Overseas Airways is to greatly improve its prewar service from England to the Middle East including Cairo, points on the Eastern Mediterranean, Baghdad, Basra, Abadan, and Bahrein Islands. In the case of the American companies the airways' fare will be reduced from 25 to 50 per cent compared with the prewar rates. Eastern Mediterranean points at present are also served from Cairo by the Misra (Egyptian) lines. Iraq Petroleum Co., Ltd., maintains its own airplane service from Haifa, Palestine, to its field headquarters in Iraq and Anglo-Iranian Oil Co., Ltd., operates four airplanes out of Abadan to its fields. It is now possible to go direct to all the principal oil-operating points of the Middle East by air.

Plans call for improved freight and passenger service from the United States to the Eastern Mediterranean and to the Persian Gulf. Port Said and Haifa are active oil ports of the Mediterranean and their facilities for the handling of oil equipment and products are complete. While train service in the Middle East is limited the connecting system running from Paris to Basra in southern Iraq is in operation again. This transcontinental rail service and a desert bus service connecting Baghdad to Damascus are widely used to and from European points by oil men of the Middle East and their families.



Familiar sight in the distribution of petroleum products in the Middle East



Multistabilization unit in Damman field of Saudi Arabia

Concessions

The only active oil concession in Iran at this time consists of approxi-

Panoramic view of Kirkuk camp in Iraq

Map showing principal oil operations of the Middle East

mately 100,000 sq. miles most of which is located in southwest Iran. In Egypt the exploration rights and concessions are all in the northern part of the country. Exploration rights or concessions cover a large part of the remainder of the Middle East oil area. There is an area in the interior of Saudi Arabia, largely unexplored, which is not under concessions and no rights or concessions have been granted by the Syrian Government covering part of that country.

The concession terms covering the actual development of proven areas for the most part are similar to those under which Anglo-Iranian Oil Co., Ltd., operates in Iran. Outside Egypt this Iranian development was the first in the Middle East and its production at present accounts for more than 60 per cent of the Middle East total. The royalty payment is 8 shillings gold per ton. The actual equivalent of this royalty in terms of dollars varies with the rate of exchange but it is generally figured on a basis of 22 to 25 cents per American barrel. The Egyptian royalty is determined on a basis of 15 per cent of the oil produced.

The concessions contain the usual provisions in regard to the employment and training of nationals. These terms permit the employment of American or British nationals for most of the administrative and top technical and scientific positions. In the older operations the nationals have been trained to do most of the routine construction and operating work. There are strong nationalistic trends in most of the countries of the Middle East and it is expected that more and more stress will be placed on the training of nationals to carry on all phases of the petroleum operations. Most of the exploration work has been in charge of American companies. American trained drillers and tool pushers predominate in field operations.

Type of Equipment

Except for steam-generation and power-plant facilities and their auxiliaries, and part of the pumping installations, most of the equipment used in Middle East oil operations is of American design and the

larger part was manufactured in the United States. Drilling operations in relation to the quantity of oil produced are small and outside Egypt no pumps are used in the production of crude oil.

American designers and builders of refinery-processing equipment have had a sizable market in the Middle East for many years. Starting in 1941 and 1942 the Allied war strategy called for the expansion of refining facilities in the Middle East as rapidly as possible. War-product plants were given as high a priority as in the United States. Complete units designed and fabricated in the United States were shipped to the Middle East plants. At the close of the war the refineries at Abadan and Bahrein Islands had large alkylation and isomerization units in operation and were important producers of 100-octane gasoline. All types of housing and utilities represent major expenditures in Middle East oil operations.

Anglo-Iranian Oil Co., Ltd., is the largest of the British oil companies and one of the major units of the entire petroleum industry. The British Government has a 55 per cent stock ownership in the company. The company has other interests in the Middle East. Through subsidiaries it has refining properties in the United Kingdom and France and its distributing facilities previous to the war covered a large part of the Eastern Hemisphere. Its general offices are located in Britannic House, Finsbury Circus, London E.C. 2, England.

Joint Ownership

Arabian American Oil Co. and Bahrein Petroleum Co., Ltd., are jointly owned by Standard Oil Co. of California and The Texas Co. The Bahrein company is incorporated in Canada and Arabian American is an American company. Through the California Texas Oil Co., Ltd., (Cal-Tex) the same parent companies are joint owners of a marketing organization which operates over part of the Eastern Hemisphere. The headquarters of the Bahrein company are located at 135 East Forty-second Street, New York City, and the main offices of Arabian American are located at 200 Bush Street, San Francisco.

Each of the following companies owns a 23¾ per cent interest in the Iraq Petroleum Co., Ltd.; d'Arcy Exploration Co., Ltd., (Anglo-Iranian Oil Co., Ltd.); Anglo-Saxon Petroleum Co. (Royal Dutch-Shell); Compagnie Francaise de Petroles (controlled by French Government); and Near East Development Co. (Standard Oil Co. of New Jersey and Socony-Vacuum Oil Co., Inc.). C. S. Gulbenkian, owner of the original concession, and associates own the remaining 5 per cent. The four major interests are associated in the ownership and management of Petroleum Development Co., Ltd., (Qatar). These same four companies have concessions or exploration rights as follows: Mosul Petroleum Co., Ltd., in northwest Iraq; Petroleum Development, Ltd., in Cyprus, part of Syria, Lebanon, Palestine, Transjordan, Trucial Coast, Oman, and Dhofar; Petroleum Concessions, Ltd., in Aden and Hadhramaut; Basrah Petroleum Co., Ltd., in southern Iraq. The general offices of these associated companies are located at Ling House, Dominion Street, London, E.C. 2, England.

Kuwait Oil Co., Ltd., is jointly owned by Anglo-Iranian Oil Co., Ltd., and Gulf Exploration Co. (Gulf Oil Corp.). Its general offices are located at Britannic House, Finsbury Circus, London E.C., England.

Exploration and Reserves

Several estimates of petroleum reserves of the Middle East have been made covering part or all of the areas. Taking into consideration the different approaches used in arriving at the estimates the figures are in substantial agreement. There is agreement that the large structures ranging from 45 to 160 sq. miles in area with producing columns of from 500 to 1,500 ft. justify the large reserve estimates that have been given to all the principal producing areas. The actual recovery per acre-foot based on these estimates, it is pointed out, is small compared to the recoveries in the United States with its smaller formations. The foregoing does not apply to Egypt and the producing formations so far found in Bahrein Island are not comparable in column thickness with those of other Middle East fields.

The most publicized reserve report of the Middle East was that made in 1943 by the Technical Oil Mission sponsored by Petroleum Administrator Harold L. Ickes and headed by E. DeGolyer. A summary of this investigation follows:

Country—	Proven reserves (1,000 bbl.)	Indicated reserves (1,000 bbl.)
Iran	6,000,000	7,000,000
Iraq	4,000,000	5,000,000
Kuwait	4,000,000	9,000,000
Saudi Arabia-Bahrein Island	2,000,000	9,500,000
Qatar	.....	1,000,000
Total	16,000,000	29,250,000

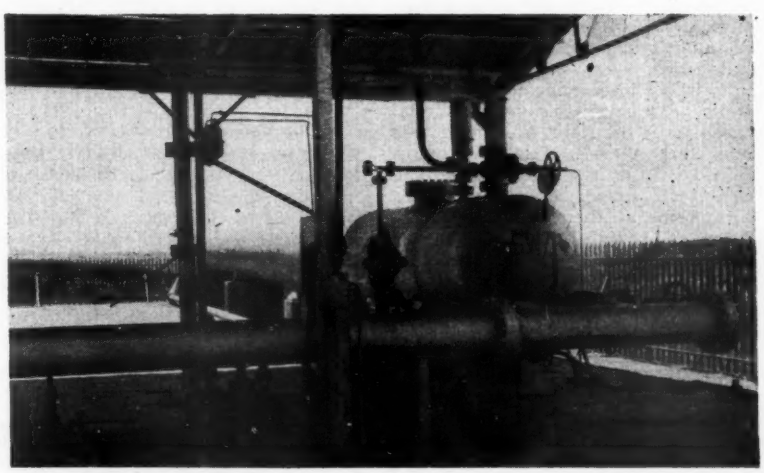
Since this report was made there have been no major new discoveries other than the completion of a wildcat well in Saudi Arabia which is now known as the Qatif field. This discovery is interpreted to add substantially to the proven reserves of that country.

Because of the large reserves found in a small part of the Middle East in recent years it is assumed that large additions will be found over the next few years. Estimates of expected reserves run into 12 figures. Those in charge of operations including some geologists who have had long experience in the area are more conservative regarding the future, pointing to the dry holes that have been drilled in recent years.

An extensive exploration program—delayed by war conditions—will get under way during 1946 in all parts of the Middle East now under concessions and as expressed by one veteran operator "by 1948 or 1949 we should know more about the potentialities of the Middle East."

Production Practices

As revealed in Table 1 little development drilling has been necessary in Middle East with the exception of Egypt where conditions in regard to producing formations are comparable to those found in several areas of the United States. With the exception of Kuwait all of the production comes from limestone. The Kuwait production is obtained from Upper Cretaceous sands. The sand column of more than 1,000 ft. is broken with shale. This field has



Well-head stabilizer of a 20,000-bbl. well in Gach Saran field of Iran

TABLE 1—SUMMARY OF MIDDLE EAST FIELD OPERATIONS

Company and Middle East headquarters—	Location of concession	No. of active fields	No. of wells	Production, bbl. daily	Proven reserves (1,000 bbl.)
Anglo-Iranian Oil Co., Ltd., Abadan, Iran	Iran	6	*116	385,000	6,000,000
Arabian American Oil Co., Dhahran, Saudi Arabia	Saudi Arabia	1	23	95,000	4,000,000
Bahrein Petroleum Co., Ltd., Bahrein Island, Persian Gulf	Bahrein Island	1	74	20,000	250,000
Iraq Petroleum Co., Ltd., Haifa, Palestine and Kirkuk, Iraq	Iraq	1	10	90,000	5,000,000
Kuwait Oil Co., Ltd., Kuwait, Persian Gulf	Kuwait	1	8	†30,000	5,000,000
Petroleum Development (Qatar), Ltd., Manama, Bahrein Island, Persian Gulf	Qatar	1	2	.....	500,000
Total		11	133	620,000	20,750,000
Anglo-Egyptian Oilfields, Ltd., Cairo	Egypt	103	26	26,000	75,000

*Includes 26 inactive wells and 39 observation wells. Actual production coming from 51 wells. †Scheduled output by March 1946.

not produced crude oil in commercial quantities and the method of operation has not been finally determined.

In the other fields there is sufficient uniformity in producing formations conditions to justify in all cases an operation in which current output is being secured from a few wells. The Kirkuk field in Iraq and the five fields in southwest Iran which are producing at this time are comparable in reservoir conditions and the recovery practices are similar. Oil and gas seepages are found at several points in the entire area and part of the exploration work has been tied into these surface indications.

The outstanding characteristic of the Kirkuk and the southwest Iranian fields is the presence of fissures which provide a free interconnection between wells and in effect permit the uniform draining of the producing structure from a few outlets. In the case of the Kirkuk field the structure is 65 miles long and 2½ to 3 miles wide. The present production of 90,000 bbl. daily is coming from 10 wells located at one end of the field over an 8-mile area. It is planned to increase this production to 300,000 bbl. daily by 1949 from 20 wells located over an 11-mile area. The entire structure is not only interconnected but the fluid characteristics are similar throughout the field. The method of operating a well is largely determined by the gas, liquid, and pressure tests made of the producing formations at the time the well is completed. Wells which are spaced an a "contour" basis are located at points which will facilitate uniform recovery from the reservoir.

In addition to the fissured characteristic the producing structures of the Iraq and Iranian fields have a common reservoir condition of hydrostatic pressure at the base of the column and gas pressure at the top. Through gas-oil and water-oil observation wells and changes in the operation of the flowing wells a field procedure has been perfected in which uniform water-oil levels and gas-oil levels are maintained throughout the fields. These important operations were explained in some detail in the series of articles appearing in this publication describing activities by areas. Full use of reservoir pressures is made in maintaining the required equilibrium conditions within the producing structures, in flowing the wells, and in the pipe-line movement of the oil on the surface.

Structural conditions in regard to fissures are not the same in the new Saudi Arabian fields. The limestone is more porous but the same situation applies in regard to hydrostatic and gas pressures. Observation wells for the determination of water and gas levels are an important phase of the operation in Saudi Arabia and Bahrein Islands.

A unique operation has been carried on in the Masjid-i-Sulaiman field, the first major discovery in Iran and a field which up to this time has produced in excess of 750,000,000 bbl. of crude oil and is still flowing at the rate of 75,000 bbl. daily. In order to maintain a refinery operation at Abadan in balance with the market demands the Anglo-Iranian company operates a topping plant in the M.I.S. field. When necessary part of the crude oil is topped of its light ends which are transported along with the crude-oil shipments to the refinery. The residual stock of the required viscosity is returned to the formation through injection wells connected to the gas reservoir. Tests have shown that the heavy oil settles to the water level and moves up with the water as the crude oil is removed from the reservoir. The company plans to recover the fuel oil in later operations. One theory is that the fuel oil releases more crude oil from the limestone formation than does the water contact. This operation has been reversed and the light fractions returned to the formation.

Refinery Operations

Table 2 summarizes refinery operations in the Middle East. With one exception the refineries are operated by the companies which own the producing operations and the stock ownership of these concerns has been previously explained. The

TABLE 2—REFINERIES OF THE MIDDLE EAST

Company and plant location—	Daily crude-oil capacity
Anglo-Iranian Oil Co., Ltd., Abadan, Iran	385,000
Kermanshah Petroleum Co. (Anglo-Iranian), Kermanshah, Iran and Alwand, Iraq	20,000
Arabian American Oil Co., Ras Tanura, Saudi Arabia	50,000
Bahrein Petroleum Co., Ltd., Bahrein Island	70,000
Consolidated Refineries, Ltd., Haifa, Palestine	90,000
Anglo-Egyptian Oilfields, Ltd., Suez, Egypt	20,000
Total	635,000

All of the refineries have thermal cracking and reforming facilities with the exception of the Kermanshah refineries which are topping plants serving local outlets. None of the refineries manufacture lubricating oils. The Bahrein Island and Abadan refineries include isomerization and alkylation processes and the Bahrein Island refinery has catalytic-cracking equipment. In addition to the above refineries there are crude-oil topping plants ranging in capacity from 500 to 3,500 bbl. daily located in the fields at Masjid-i-Sulaiman, Gach Saran, and Agha Jari, Iran; Ras Tanura, Saudi Arabia, and Kirkuk, Iraq. All of the refineries manufacture asphalts.

exception is Consolidated Refineries Ltd. which operates the new 90,000-bbl. refinery at Haifa. This company is owned jointly by Anglo-Iranian Oil Co., Ltd., and Anglo-Saxon Petroleum Co., Ltd., (Royal Dutch-Shell), two of the four principal owners of Iraq Petroleum Co., Ltd. The plant is operated under direction of the Anglo-Iranian company. The refinery also processes crude oil for the other owners of Iraq Petroleum the products being distributed in the Mediterranean and European area.

Properties of Suppliers

Properties of the principal crude-oil supplies in the Middle East are shown in Table 3. In the case of Kuwait, Kirkuk, Bahrein Island, and Damman the marketed production is confined to one field so that Table 1 gives the available output for those countries. A recent breakdown of the production by fields in Iran shows the following daily output: Masjid-i-Sulaiman, 75,000 bbl.; Haft Kel, 195,000 bbl.; Agha Jari, 40,000 bbl.; Gach Saran, 43,000 bbl.; Naft Khaneh and Naft-i-Shah fields on the Iran-Iraq boundary, 15,000 to 20,000 bbl. All of the production in Egypt with the exception of 1,500 bbl. daily in the Hurghada field comes from the Ras Gharib field. The methods used in making the distillation tests varied in the different areas and for that reason an exact comparison of all properties is not possible.

All the crudes of the Middle East would be classified as "sour" in the American sense that term is used. A relatively high sulfur content is common to all the crudes and this fact along with H_2S in the crude oil and gas has necessitated special stabilization and refinery operations. In the Kirkuk field all crude oil passes through a stabilization operation before being tendered to the pipe line. This serves the double purpose of removing most of the H_2S and the fixed gases. Previous to the installation af the field stabilizer there were complaints from residents of French cities in which refineries operating with the Kirkuk crude oil are located.

The presence of the sulfur compounds is of course reflected in the refinery processing and treating methods. Special attention is paid to minimizing corrosion in the crude-oil distillation and cracking operations and special studies have been made in regard to the metals giving the most efficient service. The treating operations are comparable to those used with some of the West Texas crude oils. Large quantities of sulfuric acid are required and most of the plants have their own equipment for its manufacture using the H_2S as the base material. In the refining of the intermediate products extending from the heavy naphthas to the light distillates the SO_2 process is extensively used. With this operation a kerosene is obtained which is comparable in specifications to the kerosenes from sweet crudes of the United States. This process is also used in obtaining aromatics which played an important part in high-octane aviation gasolines.

The large demands for the intermediate products of crude oil and the smaller percentage requirements for motor gasoline, compared to United States conditions, is reflected in the processing operations. The demand for the gas-oil cuts for diesel fuel and other uses from crude oils are so great that previous to the war there was comparatively little gas-oil cracking. The straight-run distillation of the crude oil supplied the gasoline markets and this was supplemented with large reforming installations to operate with the heavy naphtha cuts. These reforming operations improved the antiknock and volatility ratings of the blended motor fuels. None of the Middle East companies manufacture lubricating oils.

Supported War Program

During the war all of the plants were operated to give maximum support to the Allied program. With the exception of the Abadan and Bahrein Island refineries little change was made in the processing methods, the plants being operated to secure the largest possible yields of asphalt, residual, fuel oils, diesel fuels, and other intermediate products. In carrying out this program the reforming units of the 90,000-bbl. Haifa refinery were not operated because those directing the war operation did not want to undergo the volume loss that results.

H. W. Lane, general field manager of Anglo Iranian Oil Co., Ltd., in Iran

At Abadan, which is the petroleum industry's largest single refinery in point of crude-oil throughput, a large yield of 110-octane gasoline was secured without the installation of catalytic cracking. Isomerization and alkylation units were installed. The refinery operation incorporated a number of superfractionating installations to secure the part of the cuts used in the alkylation operation and for blending purposes. The reforming operations which exceeded 100,000 bbl. daily in capacity played an important part in securing the required hydrocarbons and blending stocks.

At Bahrein Island a refinery with a prewar 35,000-bbl. daily crude-oil capacity was expanded to double that capacity. The original plant included reforming, polymerization, and gas-oil cracking operations. The expansion was directed largely to a war-product operation. During the closing months of the war the refinery operation included catalytic cracking, isomerization, and alkylation operations and the refinery was the largest producer of 100-octane gasoline in the Eastern Hemisphere. The new 50,000-bbl. refinery at Ras Tanura which is scheduled for a 100 per cent capacity operation by January 1, 1946, incorporates the conventional type of Middle East refinery operation of combination atmospheric and vacuum crude-oil distillation and naphtha reforming with complete facilities for processing and treating a wide range of intermediate products required by the civilian markets of the Middle East.

Future Operations

Barring the discovery of new fields closer to the marketing outlets of the Mediterranean area than those now producing it does not appear probable that the crude-oil production and refinery output of the Middle East will be increased materially over the next 2 years. Several of the operations in the language of the operators need to be "rounded out" before further expansion is expedient. The war program necessitated the maximum output with minimum materials and operators generally are anxious to install supplementary equipment and make other changes in their field and plant operations which were not possible during the war.

The plans for extended exploration programs have been explained. Development drilling will be necessary on an expanded scale in most fields. Most of this work, however, is necessary to maintain present production and no company has announced plans for an immediate expansion of its production.

Anglo-Iranian Oil Co., Ltd., has announced plans to install extensive catalytic cracking equipment at its refinery. Other processing and treat-

TABLE 3—DISTILLATION TESTS OF MIDDLE EAST CRUDE OILS

	Iran				Kirkuk,	Egypt		Bahrein	Damman, Saudi
	MIS, HK‡	Agha Jari	Gach Saran	Kuwait	Iraq*	Ras Gharib	Hurghada†	Island	Arabia
°A.P.I. gravity 60/60° F.	37.8	36.2	32.5	33.0	35.6	†25.6	Composite	32.2	34.7
Specific gracity, 60/60 °F.	0.836	0.844	0.863	0.860	0.847	0.900		0.864	0.851
Vis. S.S.U./100° F.	...	...	...	49.8	...	78.4		58.5	42.7
Flash (oct.), °F.	...	...	...	Below 60	...	Below 50		...	...
Pour, °F.	...	...	...	—10	...	+25		+20	+10
Sulfur (weight), per cent	1.10	1.37	1.72	2.06	2.0	2.5		2.21	1.75
A.S.T.M. distillation:									
I.B.P., °F.	104	104	104	110	113	116	120	131	118
5 per cent over at	160	190	200	200	160	240	257	204	180
10	200	240	247	248	205	316	325	252	230
20	270	325	340	330	270	437	453	338	318
30	340	414	440	417	355	550	558	429	407
40	418	500	530	506	441	..	...	523	502
50	496	572	...	590	535	...	...	618	593
Recovery, per cent	59	50	45	50	50	33	32	52	54
Over at, °F.	572	572	572	590	535	572	572	624	635
Residue, per cent	40	47	51	49	49	66	67	49	45
Loss, per cent	1	3	4	1	1	1	1	0	1

*Stabilized. †Hurghada crude = 22-24 °A.P.I. ‡Masjid-i-Sulaiman and Haft Kel.

ing equipment is needed. A new office building at the Abadan refinery is projected and extensive housing facilities of various types are to be built at Abadan and in the fields when materials and manpower are available.

In Saudi Arabia the immediate program calls for a pipe line which will give the Abqaiq field its first outlet. This crude is needed for the 100,000-bbl. daily operation now required to support the new Ras Tanura refinery and the 45,000 to 50,000-bbl. production which is supplied to the refinery on Bahrein Island. All of this production is now coming from the Damman field. The company has a drilling program for the Abqaiq field which at present has five wells and it will also be drilling additional wells in the new Qatif field which is approximately midway between the Damman field and the Ras Tanura refinery. It is estimated that more than 500 houses and other housing facilities will be built in Saudi Arabia and Bahrein Islands over the next 2 years.

The owners of the Arabian American Oil Co. have announced plans to build a big-inch pipe line connecting its present fields to an Eastern Mediterranean port. This is the largest project now under consideration in the Middle East at this time. It is assumed that 2 or more years will elapse before this project is completed. It involves extensive development work in existing fields and an extensive exploration program looking to the discovery of additional fields. It is understood that in addition to the local refineries the Arabian American company expects to make offshore shipments to European refineries.

The largest program actually under way is that of Iraq Petroleum Co., Ltd., which has placed orders for 16-in. pipe which will be used in a new system paralleling the present 12-in. lines from Kirkuk field to the terminals at Haifa, Palestine, and Tripoli, Lebanon.

Some additional drilling will also be necessary in the Kirkuk field. When this program is completed in late 1948 or 1949 the deliveries to the eastern Mediterranean will be 300,000 bbl. daily instead of the present 90,000 bbl. daily. Previous to the close of the war all of the crude oil delivered at the Haifa and Tripoli terminals was being refined at the Haifa refinery. Since then part of the crude oil belonging to the French interests is being refined in France.

Refinery Permits

As part of this expansion program the American interests in Iraq Petroleum Co., Ltd., (Standard of New Jersey and Socony-Vacuum Oil Co., Inc.) have been granted permits by the government of Lebanon to build refineries at Tripoli. The capacity of these plants has not been announced. All of the interests associated in the Iraq operation have refineries in France and in the case of the British and American companies at other European points. It is assumed that all of the increased output of the Iraq company will be used to supply crude oil for these European operations now being rehabilitated.

A more immediate operating situation has stood with disposal of the 285,000-bbl. increase that has taken place in Middle East fields and refineries since 1938. Over the next 12 to 18 months this increase presumably will not necessitate any changes in prewar distributing operations. It is now believed that at least 18 months will elapse before the Japanese-occupied Far East and Burma fields will be back to their prewar operating status. In the meanwhile the Persian Gulf fields and refineries will be called upon to supply a large part of this deficit and also the heavy demands of the American and British military in the Pacific area. Some of the civilian demands normally served by the Middle East supplies have also increased.

When these temporary outlets are ended new outlets will have to be found for the additional Middle East output. Economists have interpreted this situation to mean that increased quantities of Middle East products in the future will go to the United Kingdom and northern European. Except for the 90,000-bbl. output of Iraq Petroleum Co., Ltd., most of which went to French refineries previous to 1939, comparatively little of the Middle East production was absorbed in European markets. These markets were supplied largely from South American, Dutch West Indies and United States sources.

The fact that the tanker distances from these Western Hemisphere sources of supply are less than from the Persian Gulf largely accounted for this operating situation previous to the war. Economists have interpreted this situation to mean that Middle East operators will absorb any additional transportation costs that exist in relation to Eastern Hemisphere markets and thus provide for the increases in supplies over the prewar period and the growth assured over the next 5 years and later.

Great Progress Recorded in 1945 in Mexico's Program Of Streamlining Oil Industry

by Curtis Vinson

Most notable of the advances made this year is the improvement in refining facilities, as well as the stimulation of the search for new reserves. The country's potential daily production is placed at 145,000 bbl., though the demand is somewhat short of that figure.

THE Mexican oil industry, operated since March 1938, by Petroleos Mexicanos, the government's oil administration, is undergoing a very definite streamlining process. Far-reaching plans to add to existing petroleum reserves, to improve and expand refining facilities and to build up an adequate and rapid distribution system that will serve effectively even the most outlying regions of the republic all demonstrate this trend.

Much was accomplished during 1945, especially in refinery improvement through expansion of the Atzcapotzalco plant at Mexico City, and in the marked stimulation of exploration for new oil deposits. The program for 1946 calls for a continuation of concentrated activity in both these fields, as well as other activities.

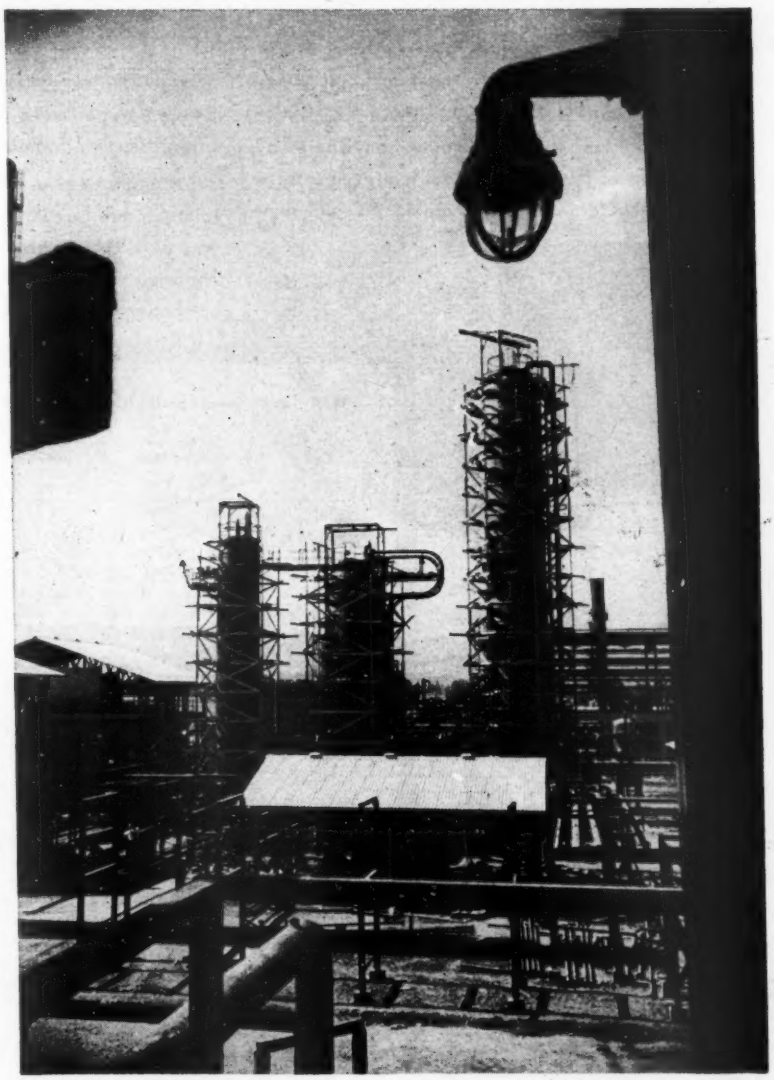
Petroleos Mexicanos (Pemex) has become more and more absorbed with the problem of supplying a rapidly-growing domestic demand. There was a time, prior to expropriation and for a few years afterward, when exports represented a major phase of the Mexican industry. But that period apparently has passed. The growing industrialization of Mexico, the spreading network of paved highways with its consequent stimulation of motor traffic, and the mounting domestic demand for kerosene and liquefied petroleum gas for household fuel are among the factors constantly augmenting the domestic market requirements.

Range of Consumption Increase

The rate of increase in domestic consumption has been ranging, generally speaking, from 6 to 7 per cent annually. In 1941, the home market consumed around 73,000 bbl. daily while exports accounted for 43,000 bbl. Estimates based on record of the first 9 months in 1945 show domestic demand for the year of 94,500 bbl. daily against an export demand of 23,300 bbl. During the past 11 years Mexico's domestic consumption has jumped 100 per cent, from 47,500 bbl. daily in 1934 to 94,500 bbl. daily in 1945.

The gradual decline in exports is illustrated by the following: In 1938, 9,615,000 bbl.; in 1939, 17,997,000; in 1940, 20,011,000; in 1941, 15,812,000; in 1942, 6,265,400; in 1943, 5,356,000; in 1944, 5,000,000 bbl., the low record since expropriation; and in 1945, 8,400,000 bbl. (estimate based on record of first 10 months of the year).

The high volume of exports during 1939, 1940 and 1941 was accounted for by especially heavy shipments to the United States, and to European belligerents. Beginning



Cracking unit columns, Atzcapotzalco refinery expansion, Mexico City

INCREASE the service life of your drilling strings, and DECREASE maintenance costs, with

REED *Super Shrink-Grip* TOOL JOINTS

The Reed Super Shrink-Grip Tool Joint has all of the advantages of the Reed Shrink-Grip "Safety Area" design, plus the advantages of field application, anywhere, by hand. No gauging of the pipe and tool joint is necessary as a gauging shoulder is provided within the tool joint upon which the end of the drill pipe lands. This shoulder assures proper make-up and also affords an added seal and protection against leakage and failure.

All threads have a wide, flat crest and root and all tool joint pin and box threads are threaded on a common axis to assure dependable axial alignment. This is extremely important as torsional stresses are greatly reduced and the hazards of costly failures minimized.

REED *Super Shrink-Grip* TOOL JOINTS FOR INTERNAL UPSET DRILL PIPE
FULL HOLE

SIZE	Tool Joint Dia. O.D.	Tool Joint Dia. I.D.	Tool Joint Length Approx.	Diameter of Upset Drill Pipe: Diameter of Land	Diameter of Upset Drill Pipe: Inside Diameter
*2⅜"	4"	1⅞"	17"	3"	1 ¹¹⁄₁₆"
3½"	4⅜"	†2 ¹³⁄₁₆"	18"	3⅝"	2¼"
4"	5¼"	2 ¹³⁄₁₆"	20"	4⅛"	2 ¹³⁄₁₆"
4½"	5¾"	†3"	20"	4⅝"	3 ⅜"
5 ⅛"	7"	**3 ¹³⁄₁₆"	22"	5 ¹¹⁄₁₆"	4"
6⅝"	8"	5"	24"	6¾"	5"

Note: Acme Full Hole can be Furnished in Sizes: 3½"–4½" and 5 ⅛".
* Reed Full Hole, Not A.P.I. Standard. † 2 ¹³⁄₁₆" or 3 ⅜" Optional.
** 4" Optional. ‡ 1⅞" Optional.

SEMI-INTERNAL FLUSH

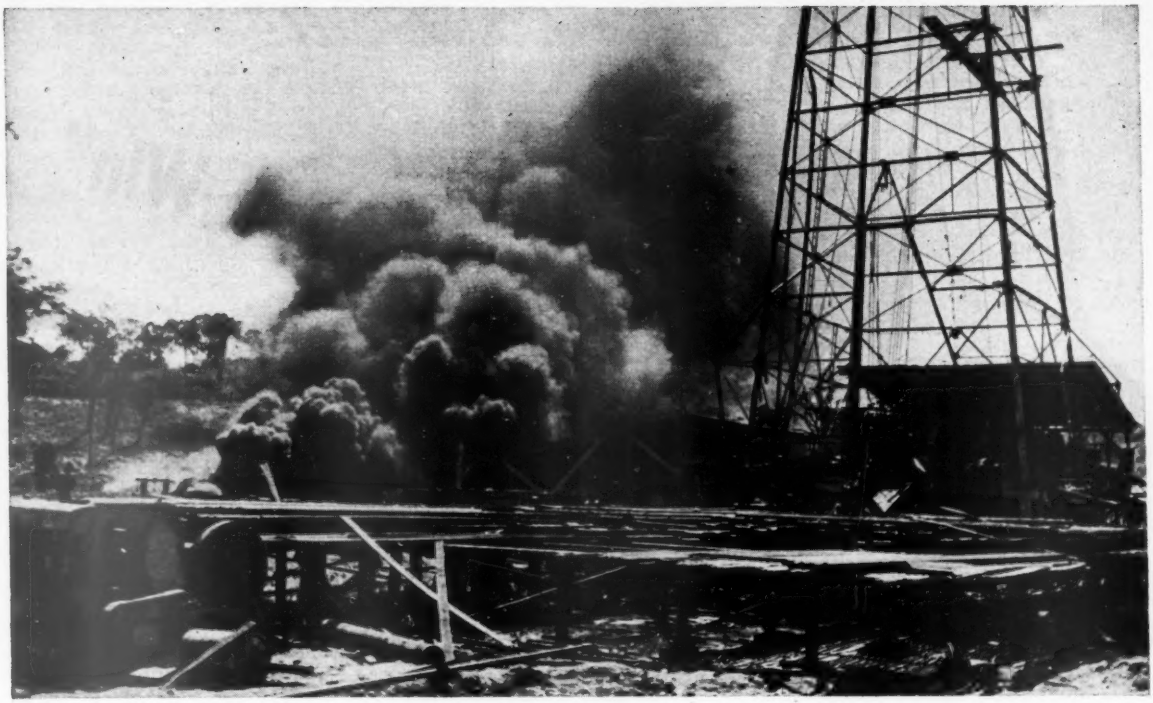
SIZE	Tool Joint Dia. O.D.	Tool Joint Dia. I.D.	Tool Joint Length Approx.	Diameter of Upset Drill Pipe: Diameter of Land	Diameter of Upset Drill Pipe: Inside Diameter
3½".....	4⅜"	2 ⅛"	18"	3⅝"	2¼"
4½".....	6"	3 ⅛"	20"	4⅝"	3 ⅛"

Note: The Tool Joint Box and Pin Connections have 4 A.P.I. Threads per Inch, with Larger Pin Diameter than A.P.I. Full Hole.

REED *Super Shrink-Grip* TOOL JOINTS FOR INTERNAL FLUSH DRILL PIPE

SIZE	Tool Joint Dia. O.D.	Tool Joint Dia. I.D.	Tool Joint Length Approx.	Diameter of Upset Drill Pipe
2⅜".....	4⅛"	2⅛"	17"	3¼"
3½".....	4⅝"	2 ¹³⁄₁₆"	18"	3⅝"
4".....	5¾"	†3"	20"	4⅝"
4½".....	6⅛"	3¼"	20"	5 ⅛"
5 ⅛".....	7⅝"	4 ¹¹⁄₁₆"	22"	6⅛"
6⅝".....	8½"	5 ¹¹⁄₁₆"	24"	7 ⅛"

† 2 ¹³⁄₁₆" or 3 ⅜" Optional.



New producer (7,400-ft. hole) coming in at Poza Rica. The well was completed as a producer in 3 months, reportedly the best record in Poza Rica

with 1941, in the wake of Mexico's declaration of war against the Axis, exports to Europe stopped and during that year and since the major export movement has been to the United States and the West Indies.

During the operation of the foreign owned companies, criticism that the Mexican industry was exploited chiefly for the export trade was raised, and with justification. Of course, in those days Mexico's domestic market for oil products was not an impressive one and this had an important bearing on the flow of oil from the country. Such conditions have changed, however, and today the situation is virtually reversed. Domestic demand far overshadows the export end. Indications, in view of Mexico's general modernization program, are that this condition may be expected to continue, indeed, become more pronounced.

In its program to cope with the present and provide against the future, Pemex is going all out in the search for new oil deposits. The reason is found in the natural decline in yield to be expected from existing but old producing areas. This decline in the major fields of the nation, fields that have been producing for years, is estimated by some experts at 10 per cent annually. Just what Mexico's petroleum reserves are is a subject fraught with considerable speculation. In the annual report on the industry of March, 1945, the official estimate was placed at 800,000,000 bbl. Later, in September of that year, President Manuel Avila Camacho, obviously on data supplied by Pemex, placed the total at 870,000,000 bbl.

Production in 1945, based on figures for the first 8 months of the year, is estimated at approximately 43,000,000 bbl. Making no allowance for increase in domestic demand and export volume (an increase that most certainly can be expected), the estimated reserves as cited represent a supply for some 20 years.

More than twice the volume of estimated existing oil reserves (870,000,000 bbl.) has been taken out of the ground in Mexico since the industry became operative. The cumulative production total for the country through 1944 is 2,166,341,810 bbl. The estimated production for 1945 increases this total to more than 2,200,000,000 bbl.

Demand Is Climbing

Mexico's potential daily production has been placed at 145,000 bbl. As yet the demand is somewhat short of that figure. But the demand is climbing at a steady rate. Back in 1940, daily average production was 120,000 bbl. It dropped to 117,500 bbl. in 1941, registered another drop to 95,100 bbl. in 1942. Then the upturn started. The daily average yield in 1943 was 95,600 bbl., in 1944 it was 104,360 bbl. For 1945, based on figures for the first 8 months, it was around 118,000 bbl.

Confronted with this unmistakable trend, a trend that the general modernization program going on in Mexico is bound to accentuate, Pemex is branching out in a major way. The Atzcapotzalco refinery expansion, a project which is scheduled to go into operation in January, 1946, represents a cost of $20,000,000, including six new units at the refinery, crude stabilization and natural-gasoline plants in the Poza Rica field and improvement of the Poza Rica-Mexico City pipe line that serves the refinery.

In addition, work was started the past September on a new 25,000-bbl. daily throughput refinery at Salamanca, in the State of Guanajuato. This plant will relieve the strain on the Atzcapotzalco plant through servicing that populous region, northwest of Mexico City and the Federal District, which includes Guadalajara, Mexico's second city; Queretaro, Morelia, the state of San Luis Potosi and adjacent areas.

The Salamaca plant itself will cost $6,000,000 and is expected to require a year in construction. In addition, a new pipe line from Poza Rica to serve the Salamanca refinery is to be constructed at a cost of another $6,000,000.

Besides these actual and proposed expenditures, totaling $32,000,000, Pemex is spending millions annually on exploration work in the search for new oil. The exploratory and drilling program in 1943 cost some $2,000,000, more than $3,000,000 in 1944, approximately the same in

then he said to himself:

"Education Will Win"

OF all the heroic plans to raise the status of the people—simplest and most practical is that of Mexico's President Camacho. Says he—

"Each educated Mexican is to teach an illiterate Mexican to read and write."

The reason for this, he explains, is that we are going into a new world where education will win. Well he knows that the passing along of primary facts, from the instructed to the uninstructed, provides the toehold for education in any line.

Well he knows that education never hurts a man, if he is willing to learn a little something after he graduates.

Well he knows the war was won by post-graduate thinking on production—by outsmarting outmoded procedures — through thousands of procedures such as—

1945, and the 1946 budget for such activities promises to be higher.

The expanded Atzcapotzalco refinery, serving the national capital and the thickly populated Federal District (containing some 1,800,000 people according to the 1940 census), will have a capacity for processing 40,000 bbl. of crude daily as against a capacity for 22,500 bbl. daily at the old plant. A feature of the expansion is that it will turn out Mexico's first aviation (100-octane) gasoline.

The new crude-stabilization and gas-absorption plants at Poza Rica, integral units of the Atzcapotzalco expansion, will process, respectively, 65,000 bbl. of crude and 70,000,000 cu. ft. of gas daily.

In order to meet the requirements of the expanded Atzcapotzalco plant, new electrically driven centrifugal-type pumps are being installed in the existing stations on the 10-in. Poza Rica-Mexico City pipe line, plus the construction of three new pump stations to give the line a total of nine stations with electrically driven pumps in addition to the steam reciprocating-pump station in the field at Poza Rica. This line has already been tested under pressure for handling 40,000 bbl. of crude daily.

Pemex engineers are taking into consideration the fact that in a few years demands on the Atzcapotzalco refinery may exceed the 40,000-bbl. daily throughput planned for initial operation and, accordingly, have drawn blueprints that will permit increase of the capacity to 50,000 to 55,000 bbl. daily.

The new Salamanca refinery will be serviced by a new 282-mile 12-in. line from Poza Rica which will parallel the Poza Rica-Mexico City pipe line for a considerable distance. The old reciprocating electrically driven pumps being replaced on the Poza Rica-Mexico City line by new pumps, will be used on the Poza Rica-Salamanca line, to be served by six pump stations.

Long Step Forward

The Atzcapotzalco refinery expansion and the new Salamanca refinery will mark a long step forward in refinery modernization, though reducing by one the number of refineries. This latter situation is accounted for by reason of the fact that the Salamanca refinery will be built partly of new, partly of old equipment, the latter from the Mata Redonda and the Bella Vista refineries at Tampico which are to be dismantled.

The existing six refineries of the industry include four at Tampico—Ciudad Madero, Arbol Grande, Mata Redonda and Bella Vista—and the Minatitlan and Atzcapotzalco plants. In addition there is the topping plant at Poza Rica which is in reality a servicing unit of the Atzcapotzalco refinery.

During the first 9 months of 1945, these seven plants processed 29,635,473 bbl. of crude, averaging for the period 3,292,830 bbl. a month. Estimate for the year on the foregoing is placed at 39,513,960 bbl. This compares with a total of 34,660,000 bbl. processed in 1944 and 33,500,000 bbl. in 1943.

Output of the seven plants for the first 9 months of 1945 was 23,942,857 bbl. of all products. This shows a monthly average of 3,215,873 bbl. Estimate for the year is placed at 38,590,476 bbl. of all products. (See table for detailed list of output).

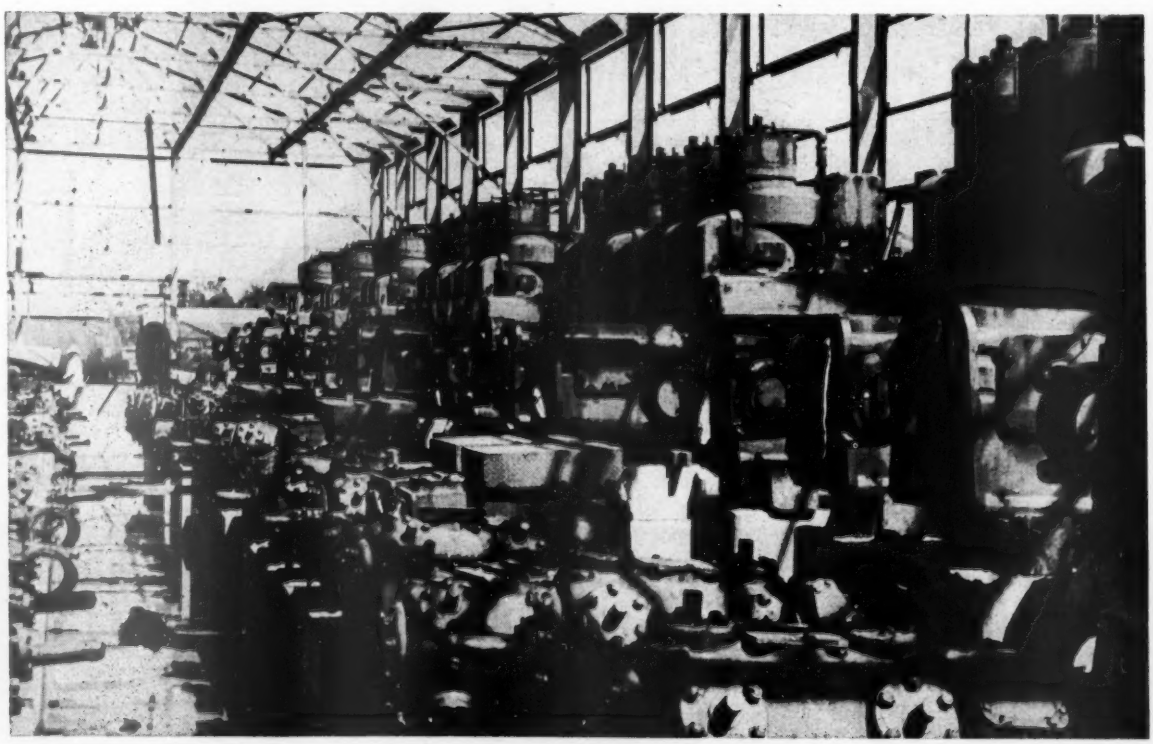
The gasoline output of Pemex refineries for the first 9 months of 1945 totaled 5,767,447 bbl. Domestic consumption (as shown by table) during the same period accounted for 3,763,164 bbl., a monthly average of 418,129 bbl. Estimated domestic consumption of gasoline for 1945, based on the foregoing, is placed at 5,017,548 bbl.

Domestic consumption of all products for 1943 totaled 25,770,000 bbl., for 1944 it jumped to 27,000,000 bbl. Estimated domestic consumption total for 1945 is placed around 34,000,000 bbl. This latter figure includes crude oil used by the industry in the field, averaging perhaps 3,000,000 bbl. annually.

About 20 per cent of domestic sales is represented by gasoline, 55 per cent by fuel oil, the remaining 25 per cent being various other products.

In the search for new oil deposits,

New compressor building for the new absorption plant at Poza Rica



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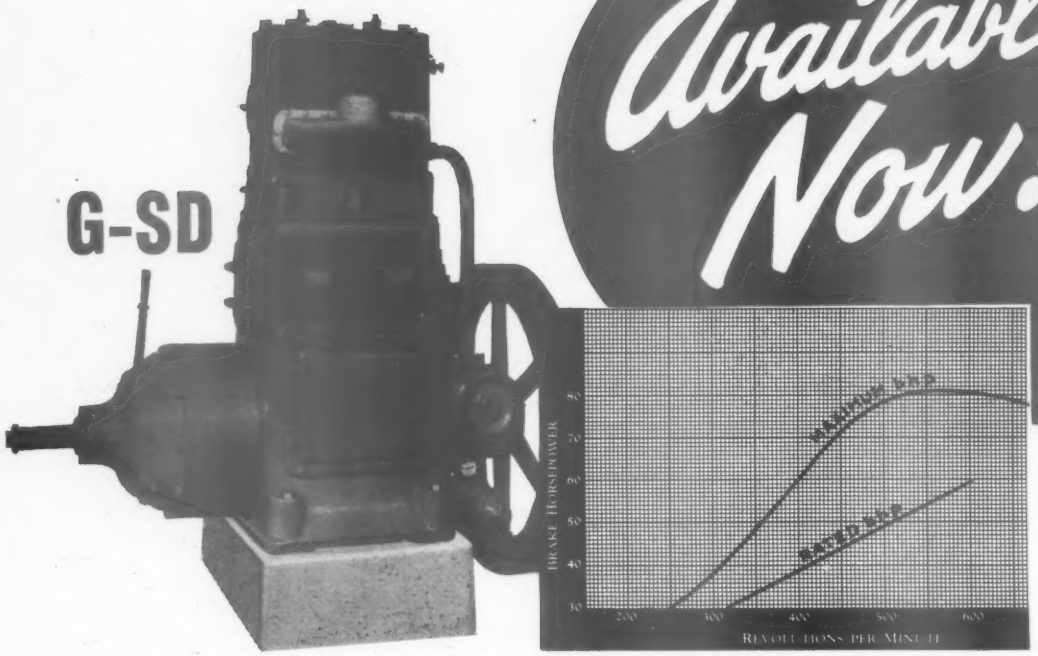

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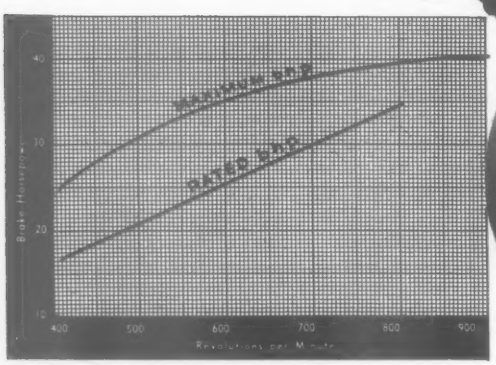

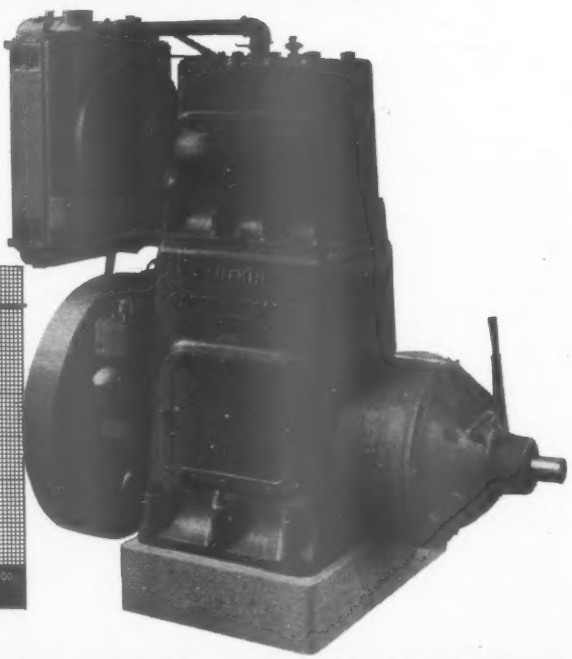

DIESEL AND GAS ENGINES

FOR COMPRESSORS, PUMPS, GENERATORS

New York Washington Bradford, Pa. Parkersburg, W. Va. San Francisco, Cal. Seattle, Wash.

New pump station for stepping up the capacity of Poza Rica-Mexico City pipe line from 22,500 bbl. daily to an expected 50,000 bbl. This is the No. 1 station, near Poza Rica, with electrically driven centrifugal-type pump. It is one of three new stations to be added to six already existing stations

Pemex employed 29 exploration parties in 1945. These included 17 geological parties, 10 geophysical parties (6 seismograph and 4 gravity meter), 1 electrical and 1 core drilling party. The total of 29 parties compared with 24 in 1944 and 16 in 1943. Up until November 1, the 1945 exploration program had resulted in the staking of 30 wildcat locations, yet to be tested.

All the exploration parties are staffed and operated by Pemex with the exception of four seismograph parties operated under contract by U.S. companies, three by Geophysical Service, Inc., Dallas, and one by Westby Geophysical Co., Tulsa. Geophysical Service plans to put its fourth party to work in Mexico early in 1946.

The exploration work is fairly well scattered over what are now believed to be the most promising areas of the country. Three geophysical and three geological parties are operating in northeastern Mexico, in the states of Nuevo Leon and Tamaulipas. Three geophysical, five geological and one electrical party are testing in the Tampico-Tuxpan region. In the Isthmus country three geophysical and five geological parties are at work and in Lower California one geophysical, one core drilling and two geological parties. The other geological parties are engaged in general reconnaissance work.

Each of the three reflection seismograph parties directed by Geophysical Service has four Americans —party chief, computer, observer, and driller. The remainder of the personnel is Mexican. Each of the two parties working in Tamaulipas in the vicinity of Reynosa, just south of the Rio Grande from McAllen, Tex., has a complement of 40 Mexican workers. The third party, working in El Aleman area in the state of Tabasco, in the Isthmus, includes some 100 Mexicans. Geophysical Service's first party was assembled in April 1944. It is testing east of Reynosa in the hope of developing production similar to that north of the river in Texas — gas and distillate. The company's second party, that in Tabasco state, was assembled in July 1944. The third party, which got on the job in July 1945, is testing west of Reynosa.

The Westby Geophysical Co. contract party, assembled in the spring of 1945, is working in the Tampico region, southeast of the Golden Lane in an area where several wildcats have been drilled.

Geophysical Service's fourth contract party is scheduled to make tests in the Veracruz embayment. No seismograph work has been carried on there to date. Considerable optimism prevails over prospects in that region, although the nearest production is far removed in the isthmus.

Other Exploratory Work

Besides those areas mentioned exploration work is being carried on in the states of Chihuahua, Oaxaca, Guerrero, Nayarit and Chiapas.

In northeastern Mexico, new findings have been limited largely to gas and distillate. The most recent gas discovery is at Mision, near Reynosa, where a well producing some 6,000,000 cu. ft. of gas and 40 bbl. of distillate daily was brought in the past April. Southwest of the Mision well, a wildcat, Las Norias, is drilling. This test, location for which was made by a Geophysical Service party, represents the first drilling operation on cantract-party recommendation.

In the Tampico - Tuxpan region, chief interest in new development centers in the Soledad wildcat, in Guadalupe Hacienda, about 8 miles west of the Alamo field. This test, drilled on a gravity meter location, was completed in July, 1945, at 6,480 ft. for a flush yield of 40 bbl. of 42-gravity oil. Production is from the rich Poza Rica pay formation. Southeast of the Soledad wildcat, and between Soledad and Poza Rica, the Castillo de Teayo test encountered oil and gas showings around 7,800 ft. Poza Rica production comes from the 7,250-7,500-ft. level.

Half a dozen wildcats are drilling in the southern or Isthmus zone, including one on the La Venta structure, east of the Tonala River. A shallow salt dome at Rio Zanapa, near La Venta, has been reported found.

Pemex has not announced its exploration program for 1946 but it seems certain there will be no diminishment in the search for new production. The number of exploration parties reportedly will be increased to 35 or more and wildcat drilling is scheduled for northeastern Mexico, in the Tampico-Tuxpan region, and on some six structures in Veracruz and Tabasco states in the isthmus.

During the first 10 months of 1945, Pemex drilled 34 holes to get 19 producers, one 6,000,000-cu. ft. gas well, an offset to the latter showing gas and distillate, and 13

TABLE 1—CRUDE PRODUCTION IN MEXICO FOR JANUARY-AUGUST, 1945 (BARRELS)

District—Northern Zone	January	February	March	April	May	June	July	August	Total
Tampico (Panuco crude)	229,189	215,495	294,498	524,856	597,260	558,231	672,917	346,837	3,439,283
Tampico (Naranjos crude)	862,170	761,650	871,347	868,384	896,255	858,510	845,545	840,105	6,803,966
Poza Rica crude	1,829,931	1,659,201	1,833,812	1,797,342	1,934,169	1,860,821	2,006,422	2,009,064	14,930,762
Total Northern Zone	2,921,290	2,636,346	2,999,657	3,190,582	3,427,684	3,277,562	3,524,884	3,196,006	25,174,011
Southern Zone—									
Filisola	29,758	25,745	27,179	29,299	28,299	26,034	26,097	24,751	217,162
Tonala	73,775	64,233	74,675	70,335	65,120	58,642	73,845	78,807	559,432
El Burro	40,734	33,211	46,527	43,483	46,477	51,956	64,781	67,926	395,095
El Plan	265,419	227,623	261,884	243,750	260,607	258,601	280,169	265,155	2,063,208
Cuichapa	24,852	14,631	20,323	23,449	36,689	32,173	31,324	32,173	215,614
Sarlat	3	2	3	2	3	2	3	3	21
Total Southern Zone	434,541	365,445	430,591	410,318	437,195	427,408	476,219	468,815	3,450,532
Total Prod. in Republic	3,355,831	3,001,791	3,430,248	3,600,900	3,864,879	3,704,970	4,001,103	3,664,821	28,624,543

Note: Table prepared by Production Department, Petroleos Mexicanos.

dry holes. Total new flush production for the period amounted to 11,062 bbl. daily. Of this, northeastern Mexico accounted for 40 bbl., the North Tampico district for 258 bbl., Poza Rica for 9,714 bbl. and the Isthmus for 1,050 bbl.

The drilling record for the 10 months is as follows:

NORTHERN ZONE: Mision No. 1, Fraction A of La Mision Land, Reynosa municipality, Tamaulipas; completed April 10 at 6,040 ft. for 6,000,000 cu. ft. of gas and 45 bbl. of distillate.

Ojital No. 3, Lot 152 of Ojital and Potrero Hacienda, Papantla municipality, Veracruz; completed May 7 at 8,029 ft., nonproductive.

Soledad No. 1, Fraction A of Guadalupe Hacienda, Temapache municipality, Veracruz; completed July 30 at 6,480 ft. for 40 bbl. of 42-gravity oil.

Mision No. 2, Mision land, Reynosa municipality, Veracruz; completed October 31, at 6,098 ft., for unmeasured gas and distillate production.

NORTHERN TAMPICO DISTRICT:

Dicha No. 182, completed January 30, at 2,188 ft., nonproductive.

Dicha No. 179, completed February 19, at 2,312 ft., nonproductive.

Dicha No. 183, completed February 27, at 2,368 ft., nonproductive.

Dicha Oriental No. 159, completed April 11, at 2,075 ft., nonproductive.

Dicha No. 184, completed May 2, at 1,925 ft., for 31 bbl.

Dicha No. 185, completed June 3, at 1,934 ft., for 126 bbl.

Rincon No. 35, completed June 13, at 1,975 ft., nonproductive.

Rincon No. 36, completed June 16, at 1,642 ft., for 38 bbl.

Rincon No. 38, completed July 27, at 2,134 ft., nonproductive.

Rincon No. 37, completed August 28, at 1,529 ft., for 25 bbl.

Rincon No. 29, completed September 5, at 2,125 ft., for 38 bbl.

Rincon No. 46, completed October 6, at 2,016 ft., nonproductive.

Rincon No. 48, completed October 13, at 2,050 ft., nonproductive.

Rincon No. 49, completed October 25, at 2,132 ft., nonproductive.

POZA RICA DISTRICT: Poza Rica No. 48, completed March 25, at 7,311 ft., for 1,000 bbl.

Mecatepec No. 10, completed April 21, at 7,951 ft., for 350 bbl.

Mecatepec No. 14, completed June 13, at 7,920 ft. for 1,573 bbl.

Poza Rica No. 51, completed July 25, at 7,287 ft., for 1,573 bbl.

Poza Rica No. 49, completed July 25, at 7,390 ft., for 944 bbl.

Poza Rica No. 52, completed September 15, at 7,396 ft., for 3,774 bbl.

Poza Rica No. 53, completed October 4, at 7,363 ft., for 500 bbl.

SOUTHERN ZONE: La Venta No. 4, La Venta property, Huimanguillo municipality, Veracruz, completed May 2, at 3,647 ft., nonproductive.

Tecuanapilla No. 2, Lot 30, F. Romero Rubio first zone, Minatitlan municipality, Veracruz, completed October 11, at 2,355 ft., nonproductive.

EL PLAN DISTRICT: El Plan No. 30A, completed March 10, at 5,054 ft., nonproductive.

El Plan No. 109, completed May 30, at 7,693 ft., for 189 bbl.

El Plan No. 101, completed July 30, at 5,959 ft., for 252 bbl.

El Plan No. 128, completed September 18, at 6,232 ft., for 157 bbl.

El Plan No. 117, completed October 21, at 6,260 ft., for 132 bbl.

CUICHAPA DISTRICT: Cuichapa No. 18, completed March 15, at 2,268 ft., for 138 bbl.

Cuichapa No. 19, completed October 25, at 2,319 ft., for 182 bbl.

In improving distribution facilities, Pemex has constructed and is building bulk tank storage at various strategic supply centers throughout the republic. Since expropriation in 1938 it has built and is now building such distribution storage plants with total capacity for nearly 500,000 bbl. Of the 10 plants, the one at Salina Cruz, on

TABLE 2—MEXICO'S PRODUCTION BY FIELDS, WITH DAILY AVERAGES, FOR FIVE-YEAR PERIOD, 1940 THROUGH 1944, WITH TOTAL ALL-TIME PRODUCTION BY FIELDS (IN BARRELS)

	1940		1941		1942	
Area—	Total production	Daily average	Total production	Daily average	Total production	Daily average
Northern	6,190,000	16,900	6,015,000	16,500	3,670,000	10,000
Southern	3,770,000	10,300	5,600,000	15,350	3,850,000	10,540
Poza Rica	28,360,000	77,500	22,350,000	69,450	22,080,000	60,500
Isthmus	5,600,000	15,300	5,920,000	16,200	5,120,000	14,020
Total	43,920,000	120,000	42,885,000	117,500	34,720,000	95,110

	1943		1944		All-time
	Total production	Daily average	Total production	Daily average	production through Dec. 31, 1944
Northern	3,160,000	8,650	3,636,770	9,940	768,691,770
Southern	6,490,000	17,780	8,314,200	22,710	1,051,994,200
Poza Rica	20,500,000	56,150	21,019,040	57,430	213,389,040
Isthmus	4,750,000	13,020	5,226,800	14,280	132,266,800
Total	34,900,000	95,600	38,196,810	104,360	2,166,341,810

TABLE 3—WELL COMPLETIONS DATA, MEXICO, FOR FIVE-YEAR PERIOD, 1940 THROUGH 1944, WITH SUMMARY OF WELLS COMPLETED UP TO JANUARY 1, 1945

	1940			1941			1942			1943			1944			Total to Jan. 1, 1945		
—Area—	P.	F.	T.	P.	F.	T.	P.	F.	T.	P.	F.	T.	P.	F.	T.	Prod.	Fail.	Total
Northeastern Mexico	3	3	6	1	0	1	2	0	2	0	1	1	0	0	0	18*	88	106
Northern district	2	18	20	3	8	11	1	8	9	1	6	7	5	6	11	1,629	2,752	4,381
Southern district	0	0	0	0	0	0	0	2	2	0	2	2	0	0	0	570	738	1,308
Poza Rica	7	1	8	4	1	5	3	0	3	4	0	4	5	0	5	69	76	145
Isthmus of Tehuantepec	7	3	10	7	5	12	0	2	2	2	0	2	14	0	14	382	323	705
Other areas	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	24	24
Totals	19	25	44	15	14	29	6	12	18	7	9	16	24	10	34	2,668	4,001	6,669

*Gas wells. The chief producing fields of Mexico are the Northern District, including Southern Tamaulipas and the Tampico-Panuco area; the Southern District, including the Ozulama-Tantoyuca area, the Tempoal area, East Flank, Western Group, Tlacalula-Metlaltoyuca, and the Main Belt (Golden Lane); the Poza Rica field, including the Furbero-Papantla area; and the Isthmus of Tehuantepec, including the Saline Basin, Tabasco and Chiapas states. The area designated above as Northeastern Mexico includes Central Tamaulipas, Northern Tamaulipas, Nuevo Leon, Coahuila, Chihuahua and with it is included Lower California.

the West Coast, is the largest with capacity for 243,707 bbl. From this concentration station, much of the West Coast is supplied by tankers. The second largest is at Lerma, in Campeche, one of the southernmost states, which has a capacity for 82,-143 bbl. The third largest is being built at Brownsville, Tex., just north of the Mexican border. It will have a capacity for 30,000 bbl. and is designed to supply the northern border area. It will be serviced by ocean tankers from Tampico.

In addition to the points named there are storage plants at Acapulco, Guerrero, on the West Coast; Apatzingan, Michoacan; Apizaco, Tlaxcalla; Naco, Sonora; Punta Prieta, Lower California; Verdura, Sinaloa; Zacatepec, Morelos.

Pemex's distribution facilities include a fleet of railway tank cars and 14 ocean tankers. The railway rolling stock includes 1,471 tank cars and 94 box and flat cars. In addition, 35 tank cars are rented from the National Railways. Five ocean tankers and as many barges are used in supplying Gulf and Pacific distribution centers.

Of the exports during 1945, it is estimated that more than 1,500,000 bbl. of crude were shipped to the U.S. Atlantic seaboard. Exports included considerable movement of fuel oil to the West Indies as well as diesel and heating oil to the United States.

Now that the war is over, it is expected that the Mexican industry's need for various equipment will be met without delay. The filling of this need will add materially to the rate of the industry's expansion.

TABLE 4—WELLS DRILLED AND PRODUCERS OBTAINED IN MEXICO DURING 5-YEAR PERIOD, 1940-1944

Year—	Wells drilled	Producers obtained
1940	*44	19
1941	29	15
1942	18	6
1943	16	7
1944	34	24
Totals	141	71

*Fifteen of the 44 wells drilled in 1940 were by the Veracruzana, a Japanese financed company, which was granted drilling rights that year on considerable acreage in the Northern District. This company brought in one 200-bbl. well, completed three operations for 15 bbl. each.

TABLE 5—DRILLING ACTIVITIES IN MEXICO AS OF NOVEMBER 1, 1945

District—	Drilling	Suspended	Active locations	Total
Northern Zone	3	1	5	9
Southern Zone	1	0	0	1
Tampico Northern	0	4	2	6
Tampico Southern	0	0	0	0
Poza Rica	5	0	3	8
El Plan	7	2	5	14
Cuichapa	0	1	1	2
Totals	16	8	16	40

Note: Table prepared by Production Department, Petroleos Mexicanos.

TABLE 6—CRUDE PROCESSED IN PETROLEOS MEXICANOS REFINERIES DURING FIRST 9 MONTHS OF 1945

(Figures in barrels)

Refinery—	Total of crude processed	Avg. daily throughput for period
Ciudad Madero	12,599,696	46,152
Arbol Grande	3,826,071	14,014
Mata Redonda	1,841,454	6,745
Bella Vista*	1,132,609	4,148
Poza Rica†	305,840	1,120
Minatitlan	3,790,056	13,883
Atzcapotzalco	6,139,747	22,489
Totals	29,635,473	108,551

*Bella Vista total includes 89,678 bbl. of gas-oil. †Poza Rica processing in topping plant for supplying Atzcapotzalco. Note: Totals on crude processed from Refinery Department, Petroleos Mexicanos.

TABLE 8—MEXICO'S CONSUMPTION OF GASOLINE BY MONTHS FOR FIRST 9 MONTHS OF 1945 AND SALES PRICE RECEIVED BY PETROLEOS MEXICANOS

(Figures in liters and Mexican pesos)

Month—	Liters of gasoline	Sales price in pesos
January	69,764,767	15,235,312
February	61,519,498	13,477,623
March	67,684,157	14,797,565
April	66,699,728	14,666,609
May	69,496,141	15,200,628
June	66,327,622	14,419,501
July	67,550,450	14,750,784
August	68,731,435	14,957,227
September	60,569,385	13,198,317
Totals	598,343,183	130,701,566

Note: The total in liters converts into 3,763,164 bbl., or a monthly average of 418,-129 bbl. for the 9 months. The total in pesos (value of the peso being approximately 20 cents U. S.) amounts to $26,140,-313. Figures for table from domestic sales department, Petroleos Mexicanos.

TABLE 9—MEXICAN PETROLEUM EXPORTS DURING FIRST 10 MONTHS (JANUARY-OCTOBER) OF 1945

(In barrels)

Product—	Barrels exported
Poza Rica crude	1,267,961
Naranjos crude	929,975
Fuel oil	3,115,659
Gas-oil	1,410,872
Diesel oil 29/32	1,146
Diesel oil B	35,600
Naphtha	462
Refined gasoline	1,176
Refined kerosene	613
Fuel oil	190,886
Asphalt	22,050
Total	6,976,400

Note: Figures from export sales department, Petroleos Mexicanos.

Liquidation Officials Meet Oil-Industry Leaders

WASHINGTON.—Leading representatives of the oil industry received information concerning overseas surplus petroleum installations and storage facilities at a recent meeting with officials of the Office of the Foreign Liquidation Commissioners.

The meeting, the first of several with various industries, arranged by the fixed-installations division of FLC in cooperation with Petroleum Administration for War, was attended by 30 industry officials representing Standard-Vacuum Oil Co., California Texas Oil Co., Atlantic Refining Co., Intava Inc., Standard Oil Co. of California, The Texas Co., Socony-Vacuum Oil Co., Gulf Oil Corp., and Asiatic Petroleum Co.

Col. Sidney Gruneck, director of the division, explained that bulk sales to foreign governments were contemplated and that FLC desired to explain the status of the surpluses before any of these foreign sales were made, stressing that "time is of the essence."

After discussion it was agreed that all oil firms should be given until December 15 to submit to FLC their degree of interest in any surplus in Italy. The oil companies will continue to be notified of surplus petroleum installations in other areas as they became available.

TABLE 7—OUTPUT OF PETROLEOS MEXICANOS REFINERIES DURING FIRST 9 MONTHS (JANUARY-SEPTEMBER) OF 1945

(Figures in barrels)

Products—	Ciudad Madero	Arbol Grande	Mata Redonda	Bella Vista	Poza Rica	Minatitlan	Atzcapotzalco	Totals
Gasoline	2,117,037	462,858	588,894	168,528	49,846	452,283	1,928,001	5,767,447
Kerosene	600,673	270,518	82,085	68,900	34,874	455,841	566,307	2,079,198
Gas-oil	2,096,085	644,760	236,650	.....	18,554	625,538	112,114	3,733,701
Fuel oil and residue	6,804,444	2,253,793	861,348	848,666	196,693	1,991,041	3,348,388	16,304,373
Asphalt	643,081	68,714	.....	.....	.....	.....	.....	711,795
Lubricants	.....	11,942	.....	.....	.....	157,241	.....	169,183
Grease	.....	7,562	.....	.....	.....	3,623	.....	11,185
Paraffin	76,690	3,768	.....	.....	.....	.....	.....	80,458
Liquefied gas	41,913	.....	.....	.....	.....	.....	5,575	47,488
Various	25,956	11,413	.....	.....	.....	.....	660	38,029
Totals	12,405,879	3,735,328	1,768,977	1,086,094	299,967	3,686,227	5,960,385	28,942,857

Note: Data for table furnished by Refinery Department, Petroleos Mexicanos.

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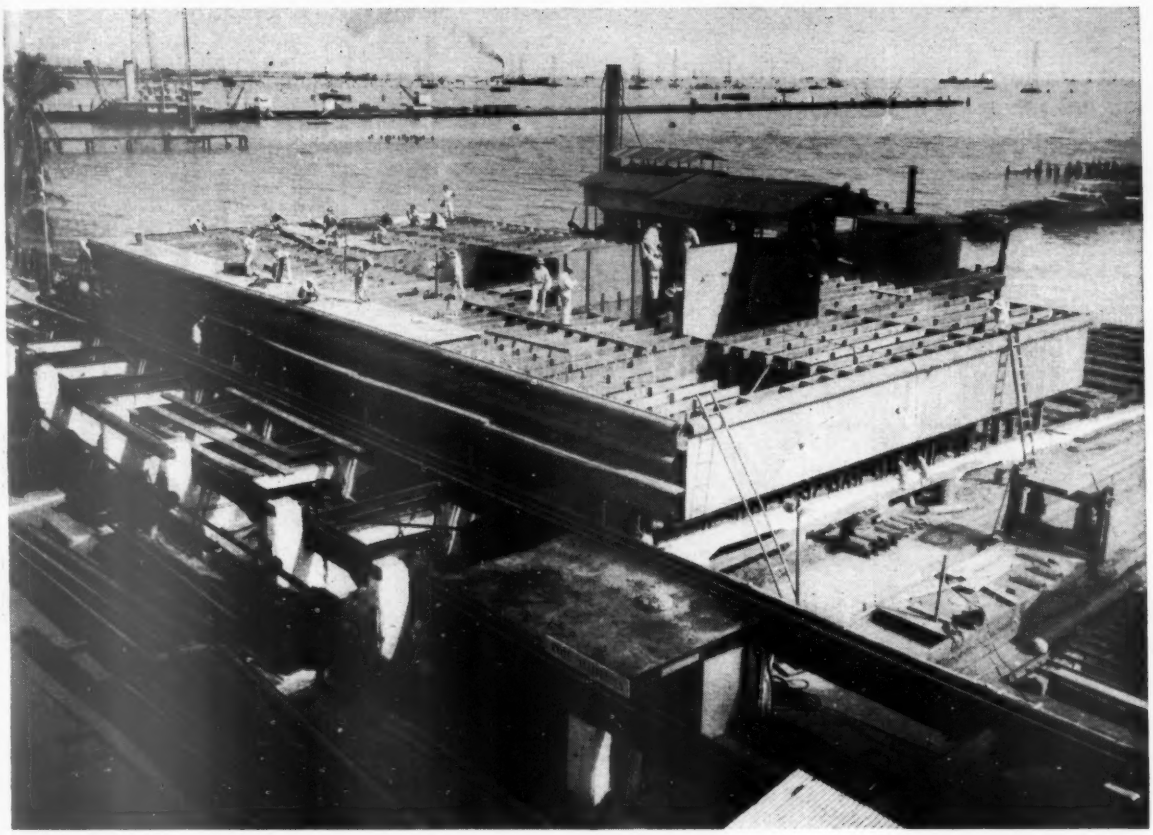
Ellinwood	Kansas



Drilling barge under construction at La Salina

Demand for Venezuelan Oil in 1945 Is Supplied Despite Some Complications

by Marian C. Cody

THE past year has seen significant developments in the Venezuelan oil industry. In a year highlighted by total world war with its special demands on the petroleum industry, emphasis has been placed on increased production to help fill the requirements for petroleum and its products. The intense effort to supply this demand has been complicated for the companies operating in Venezuela by the necessity to survey new exploratory concessions acquired under the 1943 oil law, for the purpose of selecting promising acreage in conformance with regulations, together with difficulties in obtaining sufficient material and manpower for development of the existing proven areas. The companies in general have been singularly successful in solving the problems, and in supplying crude in quantities required to supplement that produced by the United States.

Venezuela produced a total of 256,953,960 bbl. of oil in 1944. Production figures obtained from the companies in Caracas show that Venezuela produced 262,613,064 bbl. of oil for the first 10 months of 1945. On the basis of these figures a projection for the months of November and December will place Venezuelan production approximately as 320,-150,000 bbl. of oil for 1945. This represents an increase of 80 per cent.

The daily production for the entire industry in the first quarter of 1945 averaged 770,617 bbl. per day, climbing steadily to 848,622 bbl. per day in the second quarter on to 934,-217 bbl. per day in the third quarter. For the week ending November 5, production rose to a daily average of 1,007,039. For the week ending November 12, the daily average was 1,012,000 bbl. per day for the entire industry. The million-barrel-per-day objective was set by the Petroleum Administration for War in 1943 with the hope of reaching it by late 1944. Undoubtedly this goal could have been met in 1944 if it had been possible to secure the necessary essential equipment.

All development work in 1945, particularly up to the end of the war, was coordinated with the efforts of PAW, which stressed the development phase but which also permitted a reasonable amount of wildcatting and exploratory work. In 1946, development will continue on the same scale as during 1945. Emphasis, however, will be placed on exploration rather than on development.

Venezuela's future oil operations will depend largely upon its ability to supply the types of crude which will be in demand, and to deliver the crude to the chief consuming markets at a price competitive with

How to use the ATOMIC

WHETHER atomic energy is just around the corner or only a dream, one thing is certain: You can benefit from the atomic bomb project right away! New engineering principles, new processing methods, new equipment—mere by-products of the atomic bomb—have already, by a conservative estimate, more than given back America its total investment in atomic research. Some of these benefits soon will be available to American Industry. For instance:

The Medical Profession is promised a new, more abundant and more useful source of radioactivity; extension of cancer therapy; and improved methods of combating toxicity in industry.

All Industry will be offered new types of pumps, and new methods of pumping; new, more efficient heat exchangers; new high vacuum techniques; new treatment of metal surfaces to prevent corrosion; safer and more economical production and use of corrosive chemicals and gases; and greater safety in refrigeration equipment.

The Gaseous Diffusion Process for the separation of U-235 from Uranium at Oak Ridge, for which Taylor is prime contractor for process control instruments, is the largest continuous process ever dreamed of. This is the process engineered by the Kellex Corporation and operated by Carbide and Carbon Chemicals Corporation. It employs a newly conceived barrier system so efficient and so economical in operation that it has been selected as one of the processes to be continued at Oak Ridge.

As a result, industry has available for the first time, *truly proven diffusion methods.* Some almost certain benefits will be: 1) Helium produced by this method rather than by refrigeration. 2) Oxygen, Nitrogen, and other rare gases produced without resorting to liquefaction and fractional

that of other large producing areas. Strong competition, especially in European markets, can be expected from the Middle East where production has been notably increased. Venezuela, however, is in a more favorable competitive situation than at any time in the past. Long considered primarily a source of heavy crude oil, best suited to meet the demand for heavy fuels, it can now supply both medium and light crudes.

Creole Petroleum Corp.

The Creole Petroleum Corp. produces more oil per day than any other company in the world. For 10 months of 1945, Creole produced a total of 139,342,654 bbl. of oil, a figure more than double that of all the other Venezuelan companies' combined production.

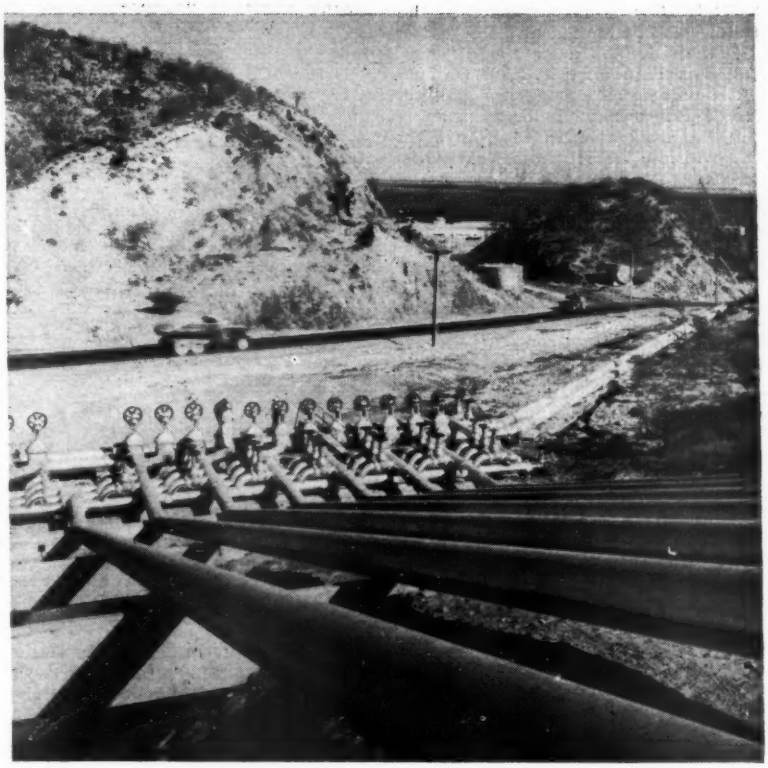
In the first 10 months of 1945, Creole drilled a total of 193 development wells in Venezuela, as compared with 196 in 1944 and 67 in 1943. Ninety wells were drilled on Creole-owned Jusepin field, 83 being oil producers, 2 gas wells and 5 dry holes. Forty-three wells were drilled in Mulata, including 39 producers, 3 gas wells and 1 dry hole. Two wells were drilled in Quiriquire and two in Cumarebo, all producers. Three producers were drilled in San Joaquin. Fifty-three were drilled in Bolivar coastal fields in Lake Maracaibo, all producers.

In addition to the development drilling, Creole has drilled five wildcats in the Jusepin area. No. J-179, drilled as a new field wildcat in the northeastern part of Jusepin to test the productive possibilities of an area separated from the field proper by a fault, was dry at

DAILY AVERAGE PRODUCTION BY MONTHS FOR 1945—CREOLE OPERATED FIELDS IN VENEZUELA
(Barrels per day)

Month—	Lake Maracaibo area	Eastern Ven. (incl. Cumarebo)	Total
January	288,693	101,552	390,245
February	285,685	122,250	407,935
March	295,968	129,116	425,084
April	309,019	132,201	441,220
May	317,603	141,015	458,618
June	287,620	158,102	445,722
July	340,394	163,769	504,163
August	337,042	164,371	501,413
September	336,260	145,180	481,440
October	358,153	164,550	522,703

Fields—Western Venezuela: Lagunillas, Tia Juana, and La Rosa. Eastern Venezuela: Cumarebo, El Roble, San Joaquin, Mulata, Jusepin, Quiriquire, Temblador, Guara, Leona, Oficina, Yopales, Santa Ana, Santa Rosa, Capacho.



Loading lines and manifold at Puerto la Cruz

TOTAL PRODUCTION BY MONTHS FOR 1944
(Thousands of barrels)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Shell	4,703	3,396	3,949	5,149	5,696	5,998	6,362	6,390	6,374	5,530	5,100	5,637	64,285
Creole	10,557	10,136	10,796	10,150	11,382	12,211	12,924	13,078	12,596	13,349	11,939	12,203	141,321
Meneg	2,050	1,087	2,318	2,505	2,815	3,128	4,018	4,299	4,444	4,485	4,254	3,706	39,108
B.C.O., Ltd.	37	36	38	33	37	42	42	40	40	37	37	39	458
Orinoco	....	....	....	....	....	....	....	....	....	....	....	....	.....
Socony	4	7	11	11	27	81	121	104	150	166	166	183	1,031
Texas	....	....	1	3	....	1	9	11	38	39	35	42	178
Consolidada	840	762	748	838	902	927	978	980	926	908	868	895	10,573
S.A.P. LS	1	....	....	....	....	....	....	....	....	....	....	....	1
Total	18,192	15,424	17,861	18,689	20,859	22,388	24,454	24,902	24,568	24,514	22,399	22,705	256,955

TOTAL PRODUCTION BY MONTHS FOR THE YEAR 1945 THROUGH OCTOBER

	January	February	March	April	May	June	July	August	September	October	Total
Shell	5,651,751	5,403,970	5,949,824	6,140,398	7,060,425	6,807,955	7,199,407	7,341,787	6,956,273	7,654,227	66,166,018
Creole	12,097,597	11,422,190	13,177,610	13,236,582	14,217,165	13,371,628	15,629,080	15,543,799	14,443,207	16,203,796	139,342,654
Meneg	4,152,220	3,782,214	4,345,061	4,243,863	4,085,653	4,377,490	4,903,231	4,978,701	4,685,879	4,855,602	44,409,914
B.C.O., Ltd.	38,223	32,736	35,697	34,961	34,297	35,134	35,920	36,169	33,971	33,243	350,351
Orinoco	.....	.....	16,185	17,631	17,174	15,256	14,660	13,679	12,568	12,099	119,250
Socony	191,212	192,285	244,939	258,697	306,975	334,720	388,247	418,271	384,908	427,030	3,147,284
Texas	45,036	37,271	62,359	41,292	45,005	40,238	46,820	79,303	75,164	72,217	544,705
Consolidada	863,909	765,436	838,547	794,285	881,143	827,316	942,048	956,373	836,002	805,804	8,510,863
S.A.P. LS	.....	489	2,315	3,668	3,774	.....	.....	.....	.....	.....	10,246
Atlantic	.....	.....	.....	.....	.....	.....	145	3,805	3,906	3,925	11,781
Total	23,039,948	21,636,591	24,672,537	24,771,376	26,651,611	25,809,737	29,159,558	29,371,887	27,431,876	30,067,943	262,613,064

9,021 ft. No. J-198, northeast of the field, was abandoned at 8,585 ft. No. J-274, drilled as a new pool wildcat, was abandoned at 6,724 ft. Two other wildcats are currently drilling. No. J-245, a new field wildcat, is plugged back at 4,197 ft. from 8,373 ft., waiting on silicate. No. J-288, another new pool wildcat, is at 3,208 ft.

Another wildcat, 5 Maturin, east of the town of Maturin just outside the city limits, was abandoned last May at 9,160 ft.

The Capacho field discovered this year by the wildcat, 1 Capacho, has proved a disappointment. No. 1 Capacho, 30 km. southwest of the company's Mulata field had an initial production of 150 bbl. per day of 23° gravity oil. Three additional wells have been drilled, all dry. No. 4 Capacho is currently drilling at 7,900 ft.

Although Creole extended the limits of its producing fields and made substantial extensions in the Bolivar coastal pools of western Venezuela and the Jusepin-Mulata area, with resultant major increases in proven acreage and reserves, developments were not as outstanding as in 1944 when the important Eocene extension in the LL-370 area of Lake Maracaibo was made together with the Guara light oil development in central Anzoategui and the northern extension of the Jusepin pool in Monagas.

The Shell Group

Venezuelan Oil Concessions, Ltd., largest producing company associated with the Royal Dutch-Shell in Venezuela has continued development of the La Paz field in western Venezuela in the State of Zulia. Late in 1944, Cretaceous production was discovered there. Since then six Cretaceous producers have been drilled, which have doubled the daily production. At the end of 1944, La Paz produced 14,000 bbl. per day compared to current output of 28,000 bbl. per day. La Paz is the first and only field in Venezuela to produce from the Cretaceous.

In August this year, V.O.C. suspended drilling operations on a deep test, No. R-801, located almost in the center of the Cabimas field on the eastern shore of Lake Maracaibo, at a depth of 13,034 ft. At this depth the well is not only the deepest ever drilled in Venezuela to date, but also—as far as is known—the deepest well drilled south of the Rio Grande and possibly in any part of the world outside of the United States. The company is awaiting delivery of special alloy drill pipe for continuing below 13,034 ft. The hole is reported in satisfactory condition and drilling is to be continued until deep productive possibilities are fully explored.

Ballenato (BA) 1, a wildcat 25 km. due east of the town of Lagunillas, was abandoned last August at 8,546 ft. Ballenato (BA) 2, 4 km. northeast of BA 1, is drilling at 2,732 ft. Curazao 2A, 14 km. east of the town of La Rosa, is drilling at 5,416 ft.

Caribbean Petroleum Co. DM 3, 25 km. northwest of Maracaibo in the State of Zulia, was coring at 6,224 ft. at the end of October. DM 3 is an outpost in the newly discovered Mara field which consists of only one producing well. DM 2 is the discovery well and at the end of October was producing 5,421 bbl. per day. The initial test in the area failed to develop commercial oil.

The Colon Development Co.

DAILY AVERAGE PRODUCTION BY MONTHS THROUGH OCTOBER 1945—FIELDS OPERATED BY THE VENEZUELAN OIL CONCESSIONS, LTD.
(Barrels per day)

	Cabimas	Tia Juana	Lagunillas	Pueblo Viejo	Bachaquero	La Concepcion	La Paz	Total
January	20,437	5,051	66,815	2,636	20,083	3,437	16,557	135,016
February	20,306	9,112	66,978	2,842	29,655	3,767	13,663	146,323
March	20,159	7,742	75,884	3,123	18,765	3,935	16,004	145,612
April	19,619	10,761	77,289	3,152	27,313	4,286	16,336	158,756
May	19,437	16,534	77,047	3,296	34,031	4,130	18,416	172,891
June	18,960	13,503	75,885	2,826	31,699	4,174	21,779	168,826
July	18,961	14,529	76,405	2,632	33,431	3,990	22,936	172,884
August	18,738	16,759	75,652	3,677	33,408	3,661	27,108	179,003
September	18,245	12,808	74,195	4,748	33,761	3,410	27,794	174,961
October	17,930	28,793	73,052	3,870	33,810	3,024	28,686	189,165

DAILY AVERAGE PRODUCTION BY MONTHS FOR 1945—FIELDS OPERATED BY CARIBBEAN PET. CO.
(Barrels per day)

Month—	Mene Grande	Mara	Total
January	30,636	.....	30,636
February	30,688	.....	30,688
March	30,431	.....	30,431
April	30,316	.....	30,316
May	37,652	1,582	39,234
June	38,584	4,462	43,046
July	38,895	5,103	43,998
August	38,084	4,145	42,229
September	37,334	4,224	41,558
October	36,618	5,421	42,039

DAILY AVERAGE PRODUCTION BY MONTHS FOR 1945—FIELDS OPERATED BY COLON DEV. CO., LTD.
(Barrels per day)

Month—	Las Cruces	Los Manueles	Total
January	10,612	6,050	16,662
February	9,905	6,083	15,988
March	9,427	6,459	15,886
April	9,616	5,989	15,605
May	10,119	5,510	15,629
June	9,824	5,233	15,057
July	10,172	5,185	15,357
August	10,684	4,917	15,601
September	10,755	4,600	15,355
October	11,272	4,434	15,706

DAILY AVERAGE PRODUCTION BY BRITISH CONTROLLED OILFIELDS, LTD, BY MONTHS FOR 1945
(Barrels per day)

Month—	Western Venezuela
January	1,233
February	1,169
March	1,151
April	1,166
May	1,106
June	1,171
July	1,159
August	1,166
September	1,132
October	....

Fields operated by B.C.O., Ltd., include El Mene, Media and Hombre Pintado.

Quiriquire pump station No. 13

IN ONE SENSE . . . time and calendars have lost their despotic power over the petroleum industry.

Only yesterday the industry annihilated time . . . compressing the technological developments of a pair of decades into months so that the march to victory could be powered with a torrent of high-octane fuels and lubricated with oils equally indifferent to desert sun or arctic cold.

Today, the postwar refinery is more than a set of blueprints locked away in the company safe. Those blueprints are out on the boards . . . being altered to meet competitive conditions of the current market. In many cases, the girders and towers for new installations are already going up.

And tomorrow?

It's no secret that Kellogg process and development engineers are well along with their work on new processes. These projects have merely generic names at the moment . . . natural gas synthesis . . . desulphurization . . . hydrogenation. But they envision the possibilities of a decrease in crude supply; the necessity for more efficient utilization of poorer grade crudes; the future need for higher quality products at lower operating costs.

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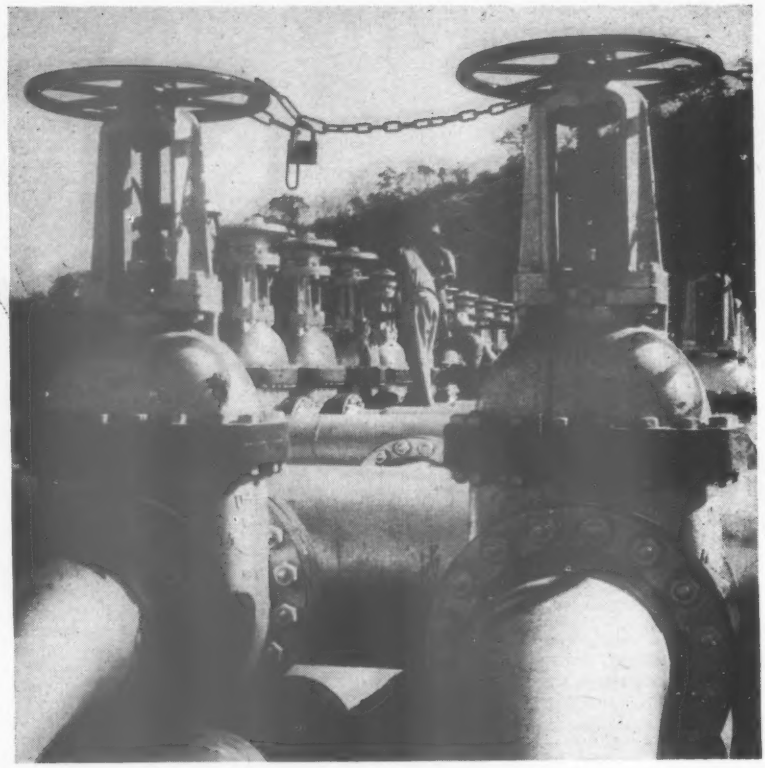


Manifold at Puerto la Cruz tanker-loading terminal

spudded its West Tarra wildcat last July, WT 1, 7 km. west of the Tarra field, and the well is drilling at 3,010 ft.

Mene Grande Oil Co., C.A.

Mene Grande has concentrated most of its development drilling in the Guara field, which produced 14,682,344 bbl. of oil in the first 10 months of 1945. Meneg, as the company is called in Venezuela, has completed 50 wells there during the year. All but one of the wells has been productive. The western side of the pool has been extended, and development to determine the size and delineation of the field will continue through 1946. GM 2, 7 km. south of the West Guara field, was completed at 7,200 ft. for 131 bbl. per day. Another well, GS 32, a stepout location east of the East Guara field, was bottomed at 7,767 ft. for a noncommercial producer.

Development also has been carried on in the Santa Barbara (Travieso) field. Thirty-five wells were drilled from January through October. Thirty-two were producers, one a gas well and the remaining two wells were dry holes. In addition, the following wildcats have been drilled in the area: BG 41, 5 km. southwest of the Santa Barbara field, was completed for 55 bbl. per day at 5,677 ft. BG 60 was spudded in November, 10 km. southwest of the field, and is currently drilling at 4,070 ft. The Santa Barbara field has proved disappointing during the year. Wells have been smaller producers than was anticipated and the drilling has been difficult. For the first 10 months of 1945, the field produced 2,506,396 bbl. of oil.

The company has drilled three wells during the year in the Yopales field, two of which were producers. In addition to development wells the following wildcats have been drilled: YS 15, in the Yopales area, 13 km. south-southwest of Oficina, was completed last January at 5,200 ft. with an initial potential of 433 bbl. per day. Another well, YS 16, 19 km. south-southwest of Oficina, was completed in March at 4,700 ft. as a dry hole.

DAILY AVERAGE PRODUCTION BY MONTHS FOR 1945—FIELDS OPERATED BY MENE GRANDE OIL CO.

(Barrels per day)

Month—	Western Venezuela	Eastern Venezuela	Total
January	34,380	99,563	133,943
February	33,742	101,337	135,079
March	31,764	108,400	140,164
April	35,591	105,871	141,462
May	37,553	94,243	131,796
June	47,198	98,718	145,916
July	50,364	107,805	158,169
August	48,316	112,288	160,604
September	51,180	105,016	156,196

Fields—Western Venezuela: La Rosa area, Tia Juana, Lagunillas, Bachaquero and Pueblo Viejo. Eastern Venezuela: Leona, Oficina, Santa Ana, Santa Rosa, Quiamare, Guara, Yopales, and Santa Barbara (Travieso).

Seven wells were drilled in Oficina, all of which have been producers. This field produced 12,916,503 bbl. in the first 10 months.

In western Venezuela, two wells have been drilled in the Bolivar coastal field area, both producers—one in the Bachaquero field and the other in the Cabimas field.

The wildcat, 8 Laguin, in the Pueblo Viejo area south of the Lagunillas field, was completed last May at 3,050 ft. with an initial potential of 2,390 bbl. per day.

In addition, Meneg is drilling four rank wildcats in the State of Anzoategui, 1 La Ceiba, 11 km. northeast from the town of Santa Rosa, drilling at 9,214 ft.; 1 Nipa, 12 km. northwest of San Tome, testing at 9,164 ft.; 1 Tacata, 30 km. southwest of the Santa Barbara field, testing at 8,199 ft.; 1 Caico, 28 km. southeast of the Santa Ana field and 42 km. northwest of San Tome, is drilling at 7,281 ft.

Socony-Vacuum Oil Co., C.A.

Socony-Vacuum has production in eastern Venezuela, in the Guico and Guario fields, in the State of Anzoategui. Guico, westward extension of Meneg's Guara field, was opened to production in 1944. Development of this field has continued through 1945 with the company operating three steam rigs. Guario is a northeasterly extension of the San Joaquin field, being operated by Creole for Mene Grande. One steam rig has been operated throughout the year at Guario.

Thirteen wells were drilled in Guico during 1945, all producers. Two producing wells were drilled in Guario. In addition to development drilling, Socony-Vacuum operated three wildcats in the western llanos, State of Barinas. San Vicente 1 was abandoned last April at 7,082 ft. Currently, two wildcats are drilling in Barinas: 1 Silvestre, 29.5 km. south and 42° east from the town of Barinas, drilling at 8,500 ft. and 1 Yaure, 15.7 km. south 23° 33′ west of the town of Santa Barbara. At least three and possibly more wildcat wells are scheduled for this area in 1946.

The company's eastern Venezuela wildcat, 1 Tascabana, spudded last

(Continued on page 258)

DAILY AVERAGE PRODUCTION BY MONTHS FOR 1945—FIELDS OPERATER BY SOCONY-VACUUM OIL CO.

(Barrels per day)

Month—	Eastern Venezuela
January	6,168
February	6,867
March	7,902
April	8,623
May	9,904
June	11,157
July	12,524
August	13,493
September	12,838
October	13,775

Socony-Vacuum only has production in the Guario and Guico fields.

Triple-Zone Completions In Eastern Venezuela

Thirty-four triple-zone wells at Greater Oficina, Venezuela, are complete; the program calls for 70. An additional 424 bbl. per day is secured for only $5,000. No trouble is experienced in workover jobs. This article tells how Mene Grande Oil Co. does it.

THE Greater Oficina area of the State of Anzoategui, in the eastern part of Venezuela, has been under development for about 8 years by the Mene Grande Oil Co., affiliate of Gulf Oil Corp. This area contains several comparatively large oil fields as well as several small fields, none of which has been completely developed. One of the most characteristic features of the fields within the Greater Oficina area is the presence of multiple productive sands. Most wells drilled to date having anywhere from two to six distinct and separate productive sands present. There have been as many as 30 separate and distinct sands present in one field, all productive to some extent.

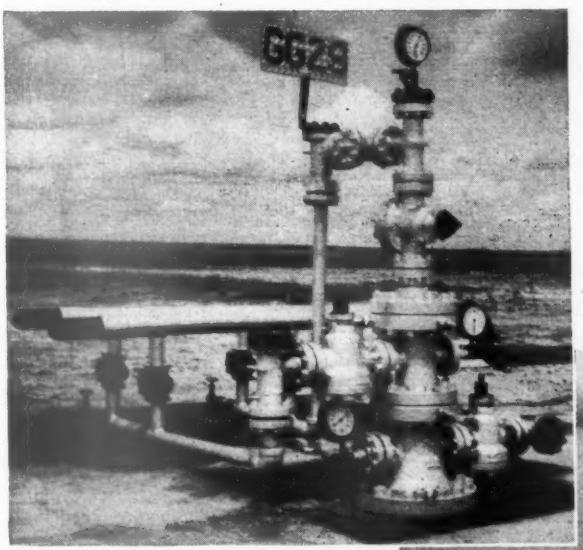
Most of the sands encountered are thin and, as a rule, are not too extensive although most recent developments in the West Guara field of Guara field, it was decided to complete a number of the wells as three-zone producers. This step was not considered too radical, as dual-zone producers have been standard completion practice in eastern Venezuela, since June 1939. One triple-zone producer had been completed in August 1941, mainly as an experiment, in the Oficina field proper.

Thirty-Four Triple-Zone Completions Already Made

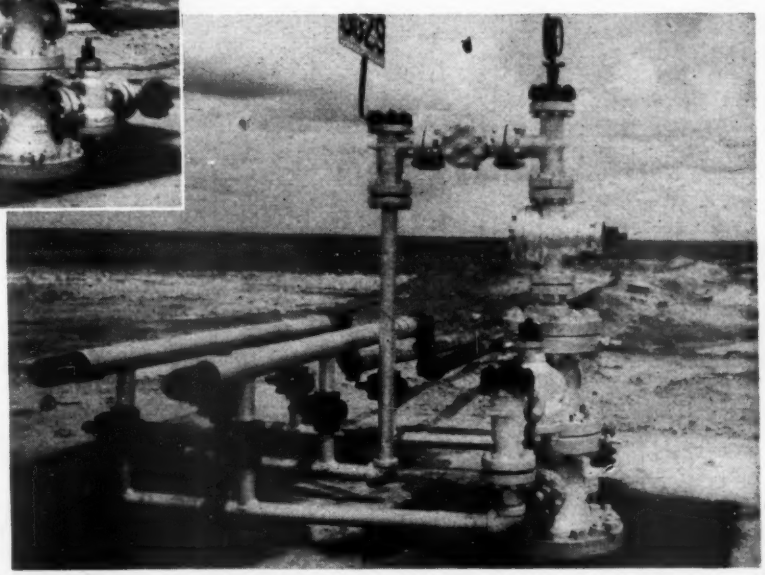
The first triple-zone completion in the West Guara field was in Well GG-29 on August 14, 1944. This was followed in quick succession by 28 additional such wells in West Guara and 5 in East Guara, some 15 km. to the east of the West Guara field. In each case separate sands are produced through the same bore hole but are produced independently through separate conductors.

In making a dual or single-zone completion in this area, approximately 247,000 lb. of steel are required for casing, tubing, christmas tree, packers, etc. Comparative figures for a triple-zone completion are 318,000 lb. of steel for the same purpose. Using a figure of 424 bbl. per day per zone, average for this area, it can be seen that a single-zone completion requires 583 lb. of steel per barrel of initial production, a dual-zone completion requires 296 lb. of steel per barrel of initial production and a triple-zone completion requires 250 lb. of steel per barrel of initial production.

	Weight of steel required (lb.)	Average initial production (bbl. per day)	Pounds of steel per barrel	Barrels of production per pound of steel
One-zone	247.000	424	583	0.00172
Two-zone	247.000	848	296	0.00343
Three-zone	318,000	1,272	250	0.00400



Below: Each zone is produced separately in the well bore. From the manifold, two 3-in. flow lines lead to the gathering station. Through one line any desired zone can be placed on test, while the second line handles the production from the other two zones

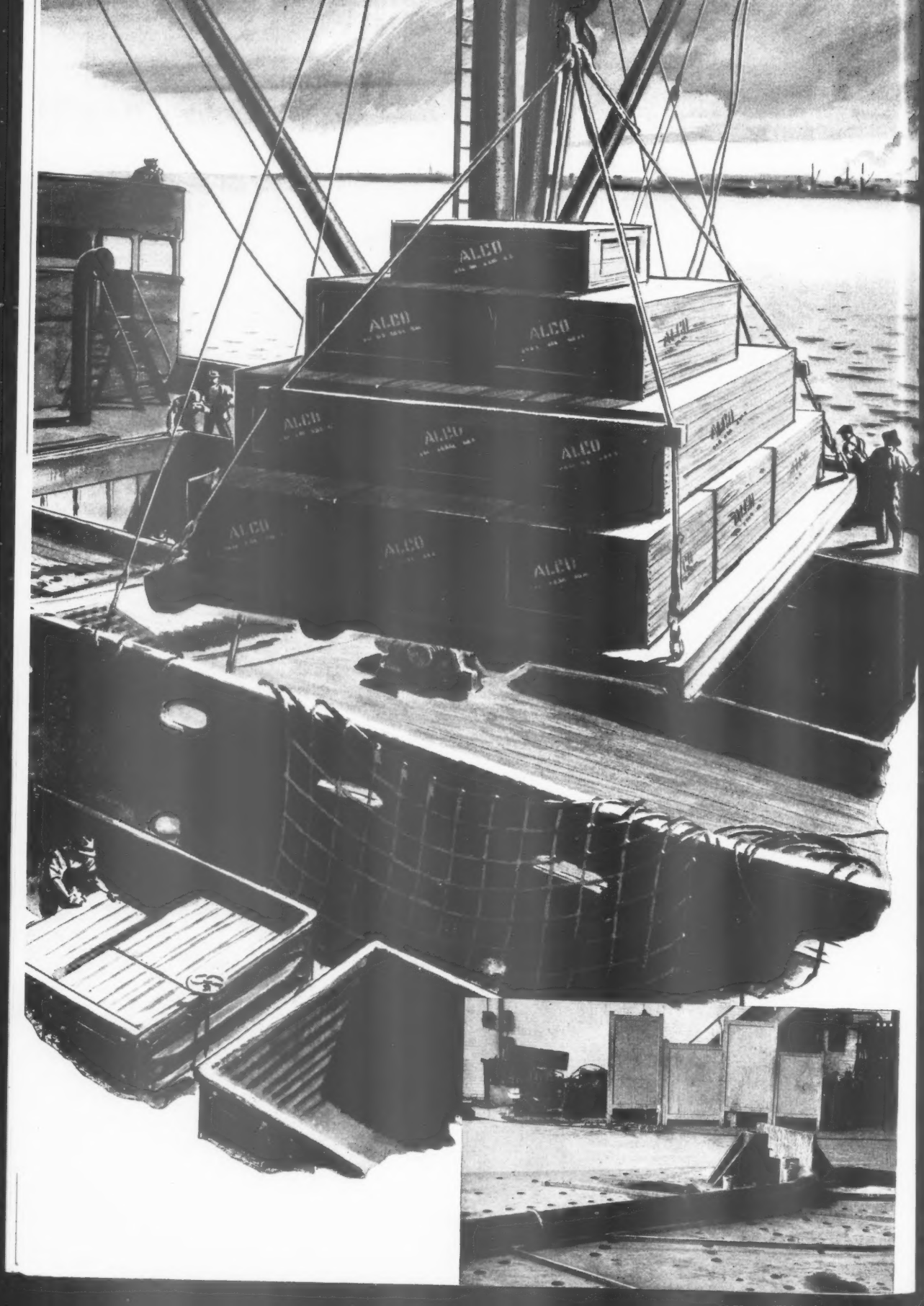


Above: This triple-zone well is the first of the program of 70 by Mene Grande at Greater Oficina

Method Obtains 424 Bbl. Per Day Additional for Only $5,000

The figures above are not the only

this area have revealed generally thicker sands covering larger areas than heretofore. Due to the recent national emergency, the availability of steel for oil-field use had been drastically cut and, at the same time, the need for oil had increased. In order to secure as much production as possible, restrict the amount of steel used, and in view of the favorable physical status of the West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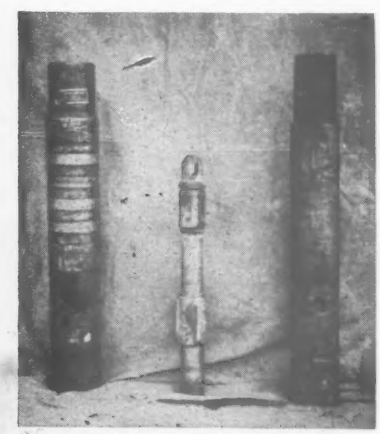
saving resulting from triple-zone completions as the expense of drilling a well is considerably higher than the cost of the casing and tubing. In addition to the saving in labor, there is less depreciation on all equipment involved, less wear on drill pipe, machinery, etc., and fewer bits required, as less hole must be dug to secure the additional production. One average well for single or dual-zone completion using 10¾-in. surface casing, 7-in. oil string and 2½-in. tubing requires about 50 days over-all time, and costs approximately $65,000. One average well for triple-zone completion using 10¾-in. surface casing, 7-in. oil string, 4-in. tubing and 2-in. tubing, requires about 50 days and costs approximately $70,000. Therefore by spending about $5,000 extra, an additional 424 bbl. of oil per day can be obtained. The larger part of this additional expenditure is for the extra string of 4-in. tubing, which is easily recoverable at a later date.

Description of Method Used by Meno Grande

Perhaps the most interesting part of this procedure is in the actual method of completion. No special labor or materials are required until after the oil string has been run to bottom and cemented and, even then, the procedure is extremely simple. (See plan of the equipment in accompanying drawing.) After a choice has been made as to which sands are to be opened to production, governed by drainage patterns and gravities desired, the selected sands are opened by gun perforating, usually employing three 8½ mm. bullets per foot. After cleaning out, scraping off the perforation burrs, and thoroughly conditioning the mud in the hole, the so-called 4-in. tubing string is made up and run in the hole. This consists of a string of 4-in. nonupset tubing, a special thin wall, large clearance, shear pin setting packer,



(Left) Special thin wall, large clearance, shear-pin setting packer; (center and right)

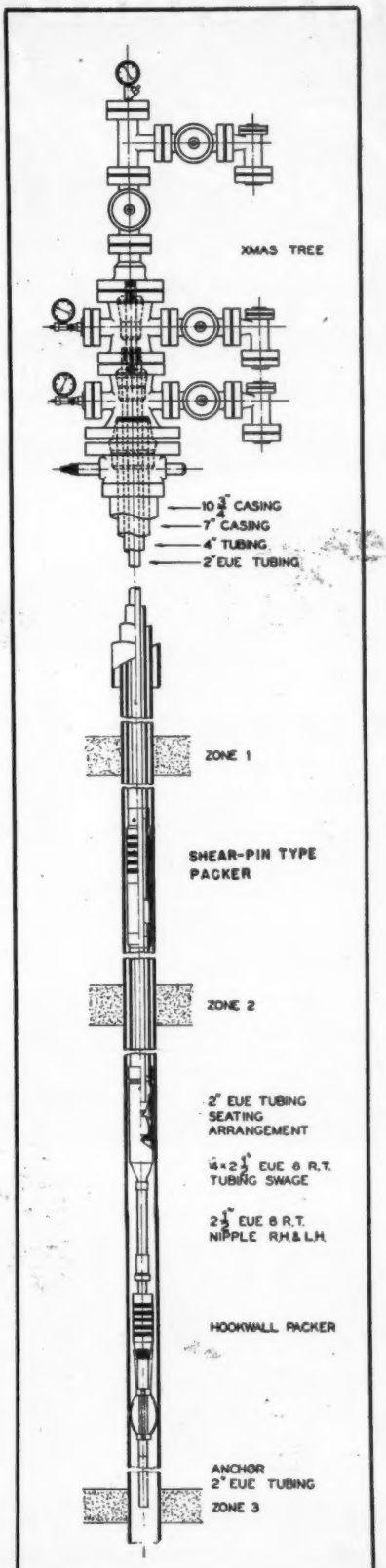
FIRST 34 TRIPLE-ZONE COMPLETIONS IN EAST AND WEST GUARA FIELDS AVERAGED 424 BBL. PER DAY PER ZONE—OR 1,272 BBL. PER WELL. THESE INITIAL TESTS WERE MADE BETWEEN AUGUST 14, 1944, AND OCTOBER 17, 1945

Well and producing zone—	Choke (in.)	Rate (bbl./day)	Gas-oil ratio	A.P.I. gravity	Per cent b.s.&w.	Flowing well head pressure
WGG-21:						
D4	1/4	260	890	44.1	0.0	475
F7	1/4	420	930	43.2	0.0	780
Mu	9/32	420	465	24.5	0.0	470
WGG-23:						
D4	1/4	368	620	43.9	0.4	625
H	1/4	403	520	41.6	0.1	625
Mu	1/4	84	480	21.0	0.4	350
WGG-29:						
F7	5/16	642	980	43.2	0.1	780
H	5/16	429	800	40.8	0.2	520
L2	5/16	560	560	30.2	0.3	500
WGG-34:						
D3	5/16	630	950	41.9	0.0	740
F7	5/16	648	930	41.5	0.2	760
H	5/16	656	955	40.8	0.4	820
WGG-37:						
F7	5/16	630	940	42.3	0.2	780
H	5/16	610	880	41.1	0.2	775
JL	5/16	183	1,610	32.5	0.2	320
WGG-41:						
D3	1/4	414	940	41.4	0.0	650
F7	5/16	564	1,130	43.2	0.0	820
L2	5/16	230	330	30.8	0.2	220
WGG-43:						
D3	5/16	565	810	41.2	0.4	660
F7	5/16	585	1,085	42.4	0.4	770
H	5/16	610	915	41.0	0.4	600
WGG-44:						
D3	5/16	615	800	41.6	0.4	630
D4	5/16	720	830	43.9	0.2	700
F7	5/16	555	960	42.5	0.4	790
WGG-46:						
D3	1/4	330	750	41.2	0.2	480
F7	1/4	424	850	41.9	0.1	610
H	1/4	393	1,340	40.9	0.2	550
WGG-51:						
F7	1/4	350	950	43.2	0.1	560
H	1/4	340	1,050	41.2	0.1	630
Mu	5/16	546	220	23.8	0.2	400
WGG-55:						
D3	1/4	326	920	42.0	0.1	650
F7	1/4	344	740	43.3	0.1	660
H	1/4	434	680	40.9	0.6	670
WGG-57:						
F7	1/4	358	830	41.4	0.2	500
H	1/4	335	950	39.9	0.2	400
L4	1/4	326	440	21.5	0.3	300
WGG-60:						
D4	1/4	326	1,100	44.2	0.0	560
F7	1/4	365	960	42.8	0.1	720
Ju	1/4	325	750	35.3	0.5	500
WGS-17:						
D3	5/16	440	840	41.7	0.6	710
F7	5/16	522	890	42.2	0.6	810
H	5/16	634	875	39.5	0.2	750
WGS-18:						
D4	5/16	450	1,300	43.1	0.0	880
Eu	5/16	670	890	42.1	0.1	690
Mu	5/16	440	390	24.7	0.4	400
WGS-19:						
F7	5/16	536	1,000	42.2	0.6	760
F8	5/16	580	470	32.5	0.4	420
H	5/16	600	900	40.1	0.4	630
WGS-24:						
D3	1/4	340	860	39.9	0.4	540
Em	1/4	402	990	41.1	0.2	675
F7	5/16	608	810	41.8	0.4	775

PRITCHARD

FIRST 34 TRIPLE-ZONE COMPLETIONS IN EAST AND WEST GUARA FIELDS AVERAGED 484 BBL. PER DAY PER ZONE—OR 1,272 BBL. PER WELL. THESE INITIAL TESTS WERE MADE BETWEEN AUGUST 14, 1944, AND OCTOBER 17, 1945

Well and producing zone—	Choke (in.)	Rate (bbl./day)	Gas-oil ratio	A.P.I. gravity	Per cent b.s.&w.	Flowing well head pressure
WGS-25:						
D3	1/4	350	850	41.7	0.1	650
D4	1/4	410	790	44.0	0.0	700
H	1/4	400	740	38.5	1.2	620
WGS-30:						
D4	1/4	450	825	43.4	0.2	840
F7	1/4	440	1,100	42.6	0.4	940
H	1/4	408	740	40.6	0.6	640
WGS-34:						
D3	1/4	348	890	41.8	0.1	680
F7	1/4	394	710	43.3	0.1	700
H	1/4	281	720	41.7	0.1	480
WGS-35:						
D3	1/4	318	700	41.8	0.4	420
F7	1/4	442	870	43.0	0.2	690
H	1/4	434	760	40.8	0.3	620
WGS-36:						
D3	1/4	321	740	41.3	0.1	555
Em	1/4	520	670	40.6	0.1	560
Mu	1/4	210	620	25.0	0.1	400
WGS-38:						
D4	1/4	273	1,350	43.4	0.2	700
F7	5/16	642	1,000	42.5	0.4	710
L4	5/16	668	440	24.5	0.2	510
WGS-40:						
D3	1/4	360	650	43.4	0.1	530
F7	1/4	451	680	43.2	0.1	670
H	1/4	448	650	40.4	0.6	615
WGS-41:						
D4	1/4	401	1,050	43.4	0.1	650
F7	1/4	426	1,000	43.4	0.1	690
H	1/4	346	1,140	42.4	1.4	715
WGS-43:						
D3	1/4	351	470	41.8	0.0	520
F7	1/4	368	540	42.4	0.0	660
H	1/4	401	480	41.3	0.1	600
WGS-46:						
D3	1/4	264	430	42.2	0.1	400
Em	1/4	342	670	41.2	0.1	520
Mu	5/16	534	480	26.5	0.1	460
WGS-47:						
D3	1/4	292	990	41.9	0.0	620
D4	1/4	416	640	42.6	0.1	610
F7	1/4	417	920	43.1	0.1	700
WGS-56:						
No. 6u and 8	1/4	330	350	47.7	1.0	325
No. 11	1/4	284	900	52.2	0.4	400
C	1/4	435	770	41.0	0.0	550
EGG-42:						
No. 7	1/4	321	490	28.6	0.1	400
AB	1/4	338	750	35.6	0.1	520
F2-3	1/4	330	600	30.0	0.1	500
EGG-62:						
Dm	1/4	460	400	29.0	0.3	490
F1	1/4	339	490	28.1	0.4	480
Ju	1/4	326	430	31.1	0.8	370
EGS-29:						
No. 11	5/16	420	250	36.5	0.4	470
F3	5/16	400	890	25.5	0.6	510
F6	5/16	480	310	28.2	0.4	560
EGS-42:						
No. 1	5/16	426	250	24.5	0.2	330
No. 6	1/4	401	280	27.5	0.2	320
No. 7	1/4	320	590	30.7	1.8	260
EGS-50:						
No. 4	Would not produce by natural flow					
No. 5	5/16	614	280	28.5	0.2	360
Eu	1/4	322	590	29.8	0.4	340



Double bottom valve and tubing seating piece

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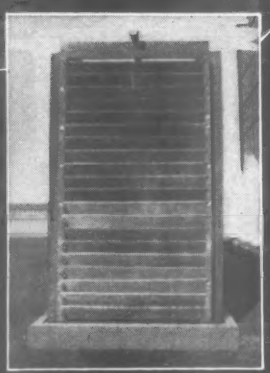

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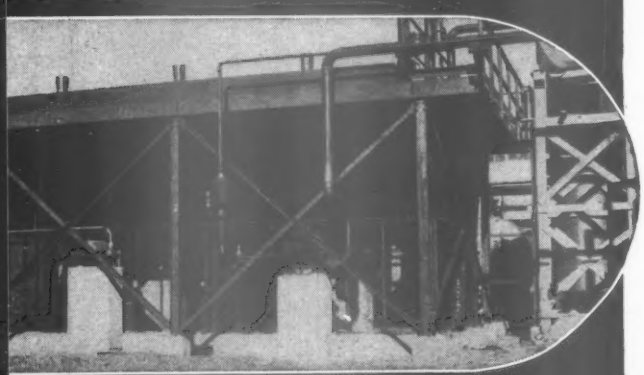

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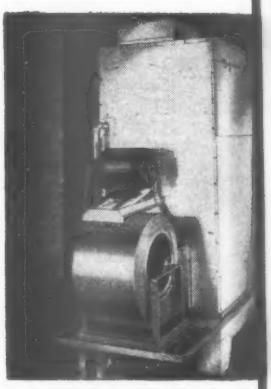

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a special double bottom valve (which will be described later), a heavy-duty hookwall packer and sufficient 2-in. tubing below the lower packer to reach the lower sand.

The packers are spaced so that the special thin-wall packer is between the upper and middle sands and the regular hookwall packer is between the middle and lower sands. The entire string is landed through a stuffing box type hanger, with the tubing screwing directly into the bottom of the 4-in. by 2-in. tubing head, but the packers are left unset.

The 2-in. E.U.E. tubing is run inside of the 4-in. string and is landed on top of the special double bottom valve, which, on receiving the weight of the 2-in. tubing, opens four 1-in. ports in the valve to permit the middle zone to enter the annulus between the 4-in. and 2-in. tubing strings, and at the same time block this annulus below the ports, and affords a seal between the 2-in. and 4-in. strings so that any fluid entering the bottom of the anchor pipe passes on up through the 2-in. tubing only. The 2-in. tubing string is also landed through a stuffing box type hanger and screws directly into the upper reducing flange on top of the 4-in. and 2-in. tubing head.

The well is then in condition for washing in. This operation is the same as used for single and dual-zone wells and consists of displacing the mud in the hole with water and then displacing the water with light gravity oil (35° A.P.I. or higher). As soon as the water has been displaced, the well starts flowing and is allowed to flow from all three exits (7-in. by 4-in. annulus, 4-in. by 2-in. annulus and 2-in. tubing) until clean, which usually requires between 15 minutes to 1 hour. The 4-in. by 2-in. tubing head is then unflanged from the 7-in. by 4-in. tubing head and the whole assembly is picked up through the stuffing box around the 4-in. tubing. Then, by turning to the left and lowering the assembly, the hookwall packer is set, which in turn sets the shear-pin upper packer, thereby isolating the three zones from each other.

Only two 3-in. flow lines are laid to the gathering station; and a header, made up of six valves, is installed at the well site. In this manner any one of the zones can be placed on test through one flow line while the other two zones are still on production and the full length of a third flow line is saved.

Due to mechanical reasons, several of the three-zone wells have required workovers during which all of the equipment must be removed from the well. This has been accomplished with the utmost simplicity, being no more trouble than an ordinary workover or cleanout job on a one or two-zone well.

While the small area of the annulus between the 7-in. casing and 4-in. tubing, and between the 4-in. tubing and 2-in. tubing is helpful in keeping the various zones on flowing production longer than would be possible in the annulus between 7-in. casing and 2½-in. tubing, it is expected that these zones will give little trouble for the most part after initiation of a proposed program to return gas to the formation in West Guara some time during 1946. (Article describing the West Guara and other new pressure-maintenance programs in Venezuela appears on page 276, this issue.) In the meantime, however, should any of the zones opened through either annulus load up and cease flow, it is a comparatively simple matter to raise one or both tubing strings through the stuffing box type hangers.

It is planned to complete some 70 wells in this manner and 30 additional sets of equipment are on order to carry out the program. Although the larger part of the proposed 70 completions will be in the West Guara field, there will be several such completions in the East Guara field and there may be several in other outlying fields.

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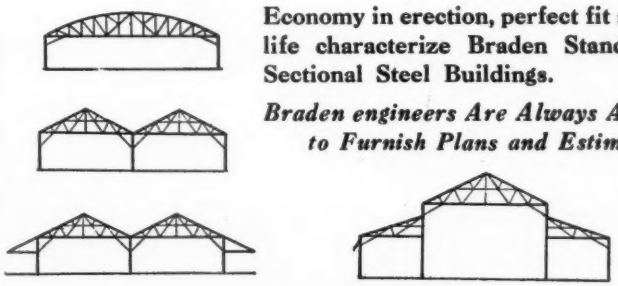

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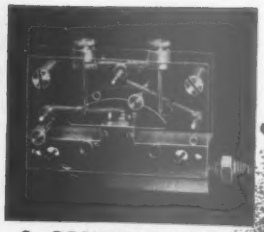
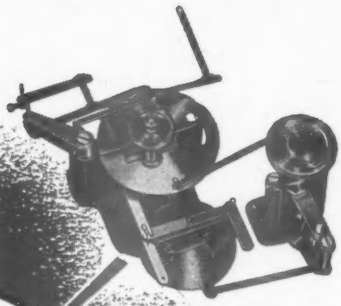


1. CONTROL HEAD



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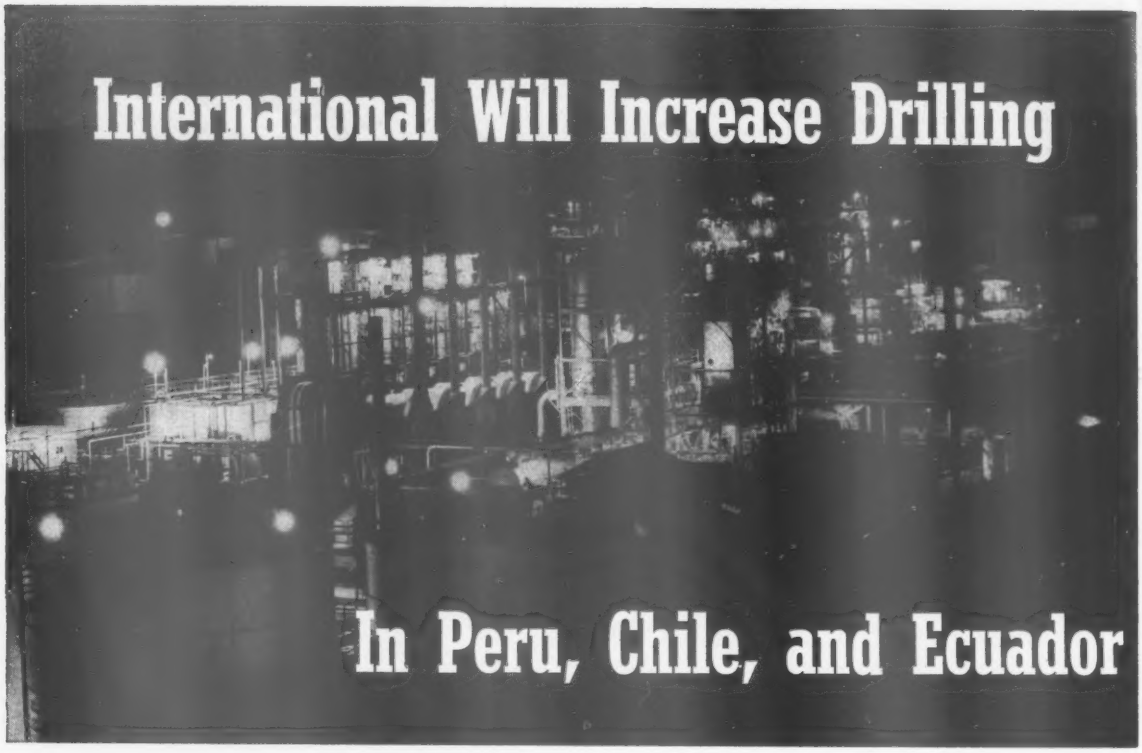


Night view of Talara refinery, Talara, Peru

IN common with other South American oil fields, operations in Peru, Colombia, and Ecuador were at times seriously handicapped during the war years, due to the lack of personnel and essential materials and sometimes by the scarcity of tankers for the transportation of crude or petroleum products. As might be expected, International Petroleum Co., Ltd., was hard pressed during some of these critical years to maintain its normal operating level. This was particularly true with regard to exploration and wildcatting activities since chief emphasis was placed on exploitation drilling in order to meet production needs for the war.

The oil fields in Peru, as a result of their strategic location in the Western Hemisphere, were an important contributor not only to military and naval operations in the Pacific theater but also to the industry and general economy of the countries situated on the west coast of South America.

The most important producing area in Peru from the standpoint of output is the La Brea-Parinas Estate which has been operated by International for more than 30 years. The proven area at this time amounts to approximately 20,000 acres and is located primarily in the northern and western sections of the property. The eastern portion of the estate due to its close proximity to the Amotape Mountains, a foothills range of the Andes, is not considered favorable to oil development. To date, over 3,500 wells have been drilled in the area and of this total more than 1,200 have been abandoned. Since many of the present producers are more than 20 years old and are down now to a yield of less than 10 bbl. per day, a considerable portion of the company's crude-oil output may be classed as stripper production. Currently about 52 per cent of the field output comes from flowing wells, 43 per cent from pumping wells and approximately 1 per cent from gas-lift wells.

Of the five producing formations in the field, Verdun, Talara, Parinas, Pale Greda, and Salina, the most important is the Parinas and nearly all the present flowing production is being obtained from four Parinas pools. A noteworthy feature in the operation of these pools has been that of complete pressure maintenance. An equivalent of 100 per cent or more of the gas produced has been returned to the formation with the result that not only has the pressure been held close to the original but it is also anticipated that practically no artificial lifting will be required to deplete these pools to their economic limit. The company has been following a policy of close gas conservation over the entire field for the past 15 years. Besides the 100 per cent pressure-maintenance

Panorama of the Portachuelo water-treating plant is seen in the cuts at the bottom of this and the opposite page

projects there are several repressuring operations under way and less than 2 years ago a recycling experiment was started in one of the pools which had reached an advanced stage of depletion. The results from this experiment would seem to indicate that this type of secondary recovery may have wider application in this field. During the current year an experimental water flood was initiated in one at the Verdun formation pools. This development will be observed with considerable interest and since almost the entire production in this field has derived from solution-gas-drive pools, the possibilities of water flooding warrant extensive investigation.

The crude-oil production of the La Brea Parinas Estate continues to show a decline notwithstanding increased drilling activity on this property.

	Production B/D	Footage drilled
Year 1943	33,030	272,032
Year 1944	32,140	295,710
10 Months October, 1945	31,222	264,280
Month of October, 1945	29,882	24,998

The company has no surplus crude available as refinery demand to meet the desired requirements of refined products for domestic and export to other South and Central American republics, exceeds the present producing rate of the producing field.

During 1946 the increased exploratory drilling program will be maintained for the discovery of new producing areas, whereby it is hoped the present producing rate may be maintained.

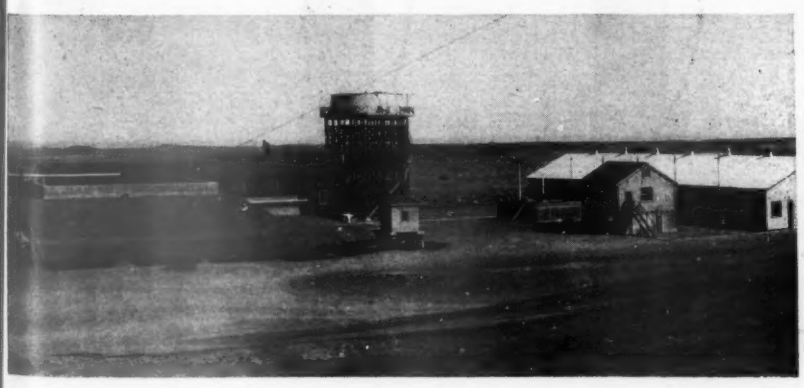
The crude-oil production of the De Mares Concession in Colombia likewise shows a decline.

	Production B/D	Footage drilled
Year 1943	31,456	18,673
Year 1944	48,390	7,969
10 Months October, 1945	42,099	54,339
Month of October, 1945	40,439	4,228

At the present time, there are four strings of tools operating on the property and during the current year the most important development was the successful completion of Galan No. 1. This well is located on the Barranca-Bermeja side of the Magdalena River opposite from Shell's Casabe field. As in the Casabe field, the producing formation is the A-zone which is characterized by heavy-oil production.

Pipe lines in the Negritos field

Fresh-water pumps at the Portachuelo plant



Tropical Oil Co. is now actively engaged in exploration work elsewhere in the country, and drilling operations on new concessions are being carried out.

International Ecuadorean Petroleum Co. is actively engaged in exploration work in Ecuador. While a total of 12 exploratory wells has been completed to date, the company has yet to find a commercial discovery. There are three exploration wells in the process of drilling at the present time and the program will be continued during 1946.

Development work in Peru, Colombia, and Ecuador accordingly involves the maintenance of the company organization in these countries at a high level of employment. There

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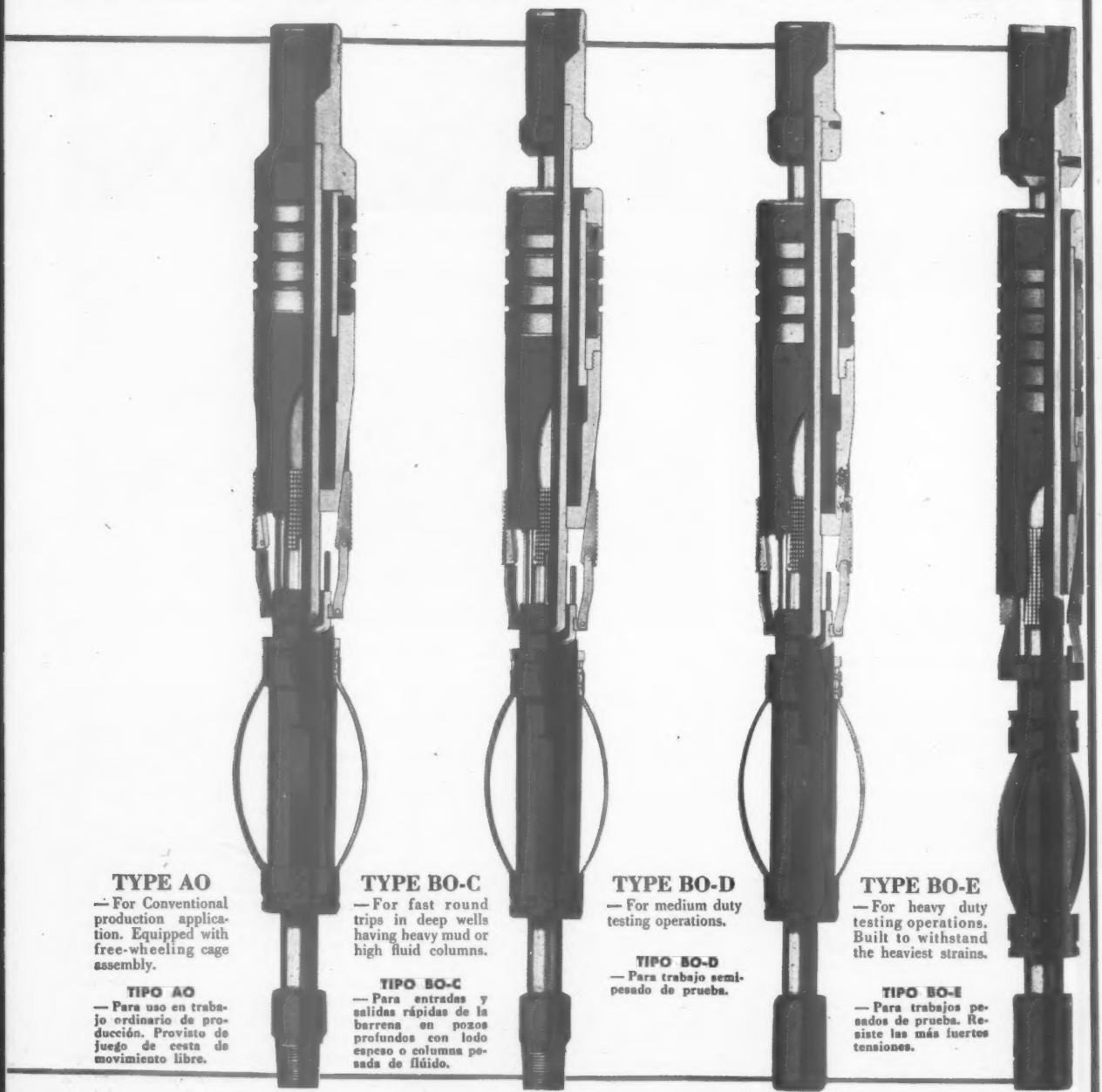

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TIPO AO
— Para uso en trabajo ordinario de producción. Provisto de juego de cesta de movimiento libre.

TYPE BO-C
— For fast round trips in deep wells having heavy mud or high fluid columns.

TIPO BO-C
— Para entradas y salidas rápidas de la barrena en pozos profundos con lodo espeso o columna pesada de flúido.

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— For medium duty testing operations.

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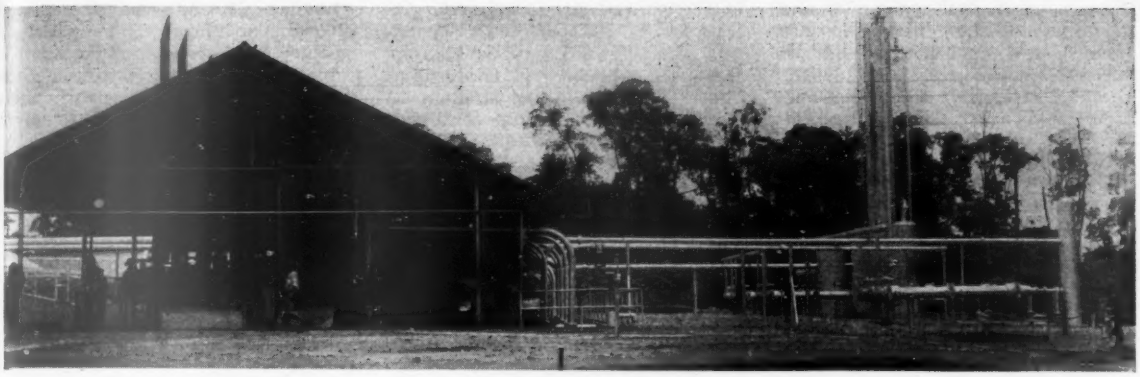
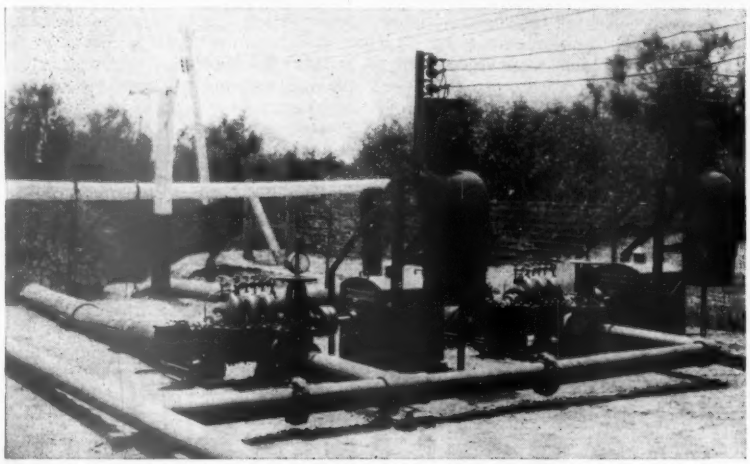


View of La Horca gas-absorption plant



Raw-water pumps at Chira River station

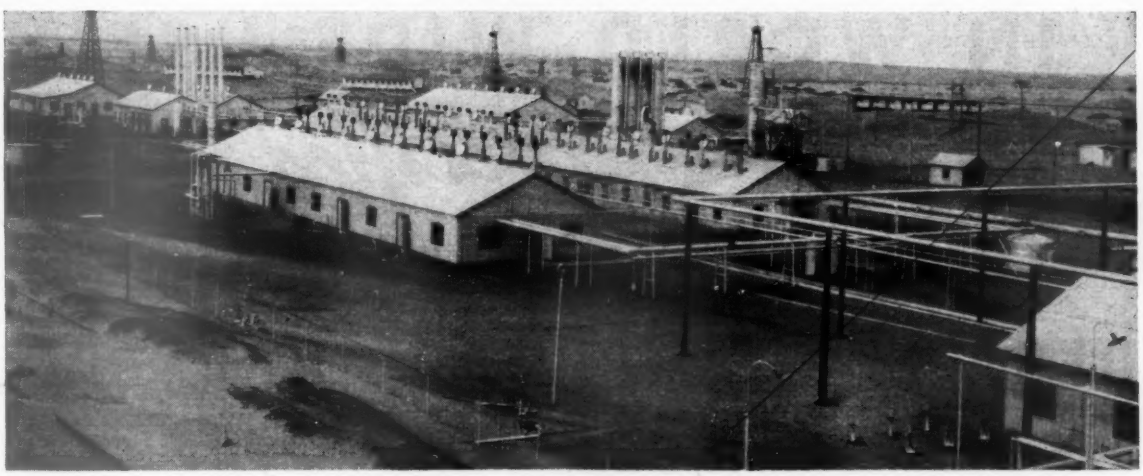
are some 12,000 employes and workmen on the payrolls and the maintenance of the organization involves the housing of workers and their families, medical and sanitation services, the operation of commissaries, fresh-water supply, education and social facilities, as well as the provision for other modern services and transportation. There are some 30,000 persons resident on the property in Peru, occupying company housing, of whom 6,000 are employed by the company. In Colombia there are between 6,000 and 7,000 persons eligible for the company's medical services on the De Mares Concession, of whom some 3,000 are employed by the company.

The continuance of the company's high level of employment, with increased payroll costs by reason of the maintenance of wage and salary rates due to higher living costs resulting from war conditions, as well as the trend toward increased social maintenance costs, constitute an important contribution to the national economy of these countries in addition to the fiscal revenues derived by the governments from International's and affiliates' operations.

In Peru there are at this time four producing areas and since three of these are quite old with relatively stable production over the past 10 years, it is improbable that any substantial additions to the present reserves will be made in these particular areas. It seems quite reasonable then to conclude that in order to improve the country's oil-production status, new concessions will have to be granted for exploration and development to petroleum companies. This procedure is necessarily very closely related to the existing laws which regulate the acquiring of new concessions.

The first modern petroleum law in Peru was enacted in 1922 and

Lomitas natural-gasoline plant



through many subsequent amendments and decrees, the various provisions now incorporated in the basic law have been considerably altered. Taken as a whole, the body of oil legislation does not contain any discriminatory features as regards national and foreign capital, but actually there is little national capital invested in the industry.

According to the present stipulations, concessions may be applied for under Law No. 4452, the existing act, but only in areas not designated as Government Reserve. In other words, concessions fall into two categories: regular, which are available in free areas, and special, which apply to restricted areas. The latter can be acquired only by negotiation and must have definite approval by Congress. The best prospective regions are the coastal belt in northwest Peru and the eastern part of the country, known as the Montana. Both of these are now included in the National Reserve.

In order to operate in the Montana, equipment must either be moved across high mountains from the Pacific side, or, up the Amazon River a distance in excess of 2,000 miles from the Atlantic coast of Brazil. Likewise, if oil should be found in commercial quantity, the production outlet would have to take either one of these two routes. To carry out such a high-cost undertaking will require large financial resources. In 1939, a major change was effected in Law No. 4452 for the specific purpose of encouraging interest and activity in Montana by increasing the maximum concession acreage and by lowering taxes. However, the government in December 1943 decreed that lands applying to the area were in the restricted zone and accordingly all action on pending applications was terminated.

Revenue derived by the government from the oil industry in Peru consists essentially of exploration and exploitation surface taxes, export taxes, and royalty. Surface taxes are on a sliding scale that ranges from one-half a sole to 10 soles per pertinencia (10 acres), depending upon the amount of crude being produced per pertenencia held. The export tax, which went into effect in July 1940, is based on 33⅓ per cent of the Mid-Continent price. Any royalty paid on export crude is deductible from export tax.

Living Standards Improved

In Colombia, the oil industry, besides providing employment to many nationalists at improved living standards, has been a very important contribution to government revenue. The total paid in income taxes, royalties, and other payments in 1942, amounted to over 10 million pesos, or approximately 6 million dollars, which constituted over 13 per cent of ordinary income. The present oil statute, however, which came into force in 1931, does not provide the incentive for continuance of healthy and growing petroleum development. Realizing this situation, the ministry of mines and petroleum has been endeavoring in recent years to write a new bill and have it submitted to Congress.

One weakness in the existing legislation is the long delay ensuing from the time an application is filed until a concession is granted. This condition arises principally from protracted title litigation in an attempt to establish whether the state or the landowner owns the petroleum subsoil rights in a disputed area. Such court proceedings may last for several years and it is important to note that while hundreds of applications comprising millions of hectares have been filed with the government, the actual number of concession contracts issued has been relatively insignificant. Another objectionable feature relates to drilling obligations which, according to interpretation of the provisions of the law, obligates an operating company to drill a well or wells before the acreage in question can be surrendered. Such a legal stipulation places an uneconomical burden on an operator since obviously on the basis of geological and geophysical work,

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the necessity of wildcatting on certain tracts is not justifiable.

A very important factor affecting oil companies in Colombia is taxation. Under present Colombian income-tax laws, decrees and regulations issued by the tax department two provisions are of economic significance to oil companies. One is the treatment of development costs on new concessions and the other the allowance for depletion.

All exploration expense on each new concession is considered as a capital expenditure under the income-tax laws. Hence if oil is not found the accumulated exploration expenses become a capital loss and as such are not a deductible expense from gross taxable income arising from other operations.

Depletion Allowance

In regard to depletion, the allowance for tax purposes is insufficient. Under the present laws and regulating decrees the accumulated development cost on a particular concession may be depleted on any basis provided the annual depletion rate does not exceed 5 per cent of the annual net income (before depletion) from the concession. This allowance is small and it is possible in some cases will not permit complete amortization of exploration and development costs within the total life (30 years) of the concession. Furthermore, the allowance does not recognize, as in the United States and Canada, where the allowances are much higher, the sound and generally accepted theory that producing companies are entitled to current tax relief, through percentage depletion, because their asset is a wasting one and only through continually spending money in search of new oil reserves can these concerns hope to remain in the business.

As previously stated, the ministry of mines and petroleum has been active in attempting to revise the present laws and while the draft of a new oil bill prepared last year was an improvement in the procedure of acquiring new concession, unfortunately in some other respects the proposed legislation was even less favorable than is now the case. Among the latter, it was recommended that maximum concession grants be reduced in the Llanos region (eastern Colombia) from 200,000 to 100,000 hectares and elsewhere in the country from 50,000 to 25,000 hectares. An immediate effect which such a requirement would have, would be the readjustment of nearly 300 application bids, thus necessitating a vast amount of work on the part of geological and engineering staffs of companies having concession contracts pending. Drilling obligations would naturally be doubled by the division of acreage, that is, two wells instead of one would have to be started after the signing of a contract.

Under the proposed law there would be an annual surface fee of three pesos per hectare, equivalent to approximately 70 cents per acre, payable during the entire concession life, or 30 years. This is in addition to the capital or "patrimony" tax now being levied on the tangible and intangible investment on a property. It may be seen that while the proposed legislation recommended the levying of new taxes, no consideration apparently was given to easing the burden on the producing companies as regards the small depletion rate allowed now on accumulated expenditures incurred on areas and concessions which prove to be nonproductive.

The drafting of an economically sound petroleum law, under which both the nation and the industry may prosper, requires a realistic approach with an understanding of the financial risk involved in the search of new reserves in remote regions and the cost of developing and producing the oil in relation to other world sources, but natural and synthetic. It is clearly a task in which legislators should seek the aid

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and best advice of independent and qualified experts, for the mutual good of the nation and industry. Such areas as the Oriente in Peru and the Llanos in Colombia are almost completely isolated, due to mountain and jungle barriers, from inhabited sections and consequently present difficult problems of supply in exploration work and wildcat drilling. These and other parts of both countries are frequently referred to as holding exceptional promise as potential oil producers, but obviously undiscovered oil is not an asset to anyone and to prove its commercial existence in these areas will call for large-scale financial and physical effort. If and when oil is discovered, further heavy outlays of capital will be needed for field development, installation of plant and equipment along with housing, medical and recreational facilities for all the personnel. Then to deliver the crude at seaboard, several hundred miles of pipe line would have to be constructed over difficult mountain terrain. These factors should be taken into account when drafting petroleum legislation and tax laws.

Colombian's Operations in Barco Concession Continue Expansion

OPERATIONS in the Barco concession of the Colombian Petroleum Co. continued to expand during 1945. Accelerated drilling has raised the daily producing capacity of the concession, and production has increased, although lack of tanker liftings have caused a number of temporary shut-ins. The daily average was more than 15,000 bbl. per day for the first 10 months of the year, with a gradual increase to approximately 16,500 bbl. in the third quarter.

Indicated total production for the Barco concession during 1945 will amount to 5,500,000 bbl., as compared with 3,500,000 bbl. during 1944. Of this total 3,850,000 bbl. will be produced by the Petrolea field and 1,650,000 from the Tibu field. Cumulative production from the Barco concession will total more than 22,550,000 bbl.

No drilling was done in the Petrolea field during the year, although a number of wells were worked over. On the North Dome, 66 wells were producing Cretaceous oil on October 1; 26 were shut-in because of high gas-oil ratios; 7 were idle, and 31 had been abandoned. No wells were abandoned during the year. On the south dome, one well was producing oil and six had been abandoned.

In the small Carbonera field, two wells were producing about 30 bbl. per day each of low-gravity oil.

In the Tibu field, 13 wells were producing Tertiary oil at a rate of about 200 bbl. per day. Seven other Tertiary wells and two Cretaceous wells were shut-in due to the delay in liftings.

There was no activity in the Rio de Oro field throughout the year. Four wells have been abandoned and nine are shut-in.

During the first 10 months of 1945 a total of nine wells were drilled and completed in the Tibu field. Three more wells are nearing completion. During 1944, eight wells were completed in this area.

The wells completed this year were 14 through 22 Socuavo—all on the northeastern part of the structure, all Tertiary producers, and all spaced to conform to a minimum 360-acre grid pattern.

Two deep Cretaceous tests are now under way in the Tibu field. They are 4 Tres Bocas on the southwest flank of the structure drilling below 9,000 ft. and 28-K Tibu on the northeast flank drilling below 2,000 ft. The hope for satisfactory production lies in the favorable development of fracture zones in the Cretaceous.

Results of Tertiary drilling this year have not been as encouraging as last year. Stepouts of the Tibu structure have encountered erratic sand development of the Barco formation, which is the main producing horizon, and it is difficult at this stage to predict what sand development may be encountered at a given location. Because of this condition it has been necessary to pump some of the newer wells from the time of their completion.

It should be noted that all new wells in the Tibu area will be called Tibu wells, and that the former designation of Socuavo wells for those in the northern part of the structure, and Tres Bocas wells in the southern part, has now been dropped.

Plans for 1946 call for a number of wide stepouts to test all parts of the structure, especially the western and northwestern regions.

Applications for Concessions in Colombia Cover 40 Million Acres

by Kenneth J. Langley

THE situation in Colombia at the end of 1945 can best be summed up by letting a few figures speak for themselves. Although the total production was only about 65,000 bbl. per day, applications on file for concessions from the Government covered almost 40 million acres. In considering the meaning of this, it is well to remember that it costs somewhere between 20 cents and $1.00 per acre just to acquire title to a concession.

Current production and exploration activities in Colombia can be divided into the following geographical areas: northern; lower Magdalena Valley; middle Magdalena Valley; upper Magdalena Valley; and the Llanos or plains region of the southwest.

In the northern area one region is producing, two are being tested. In the northeast, adjoining the Venezuelan border, the famous Barco concession is producing about 17,000 bbl. daily. In the north central region, Richmond Petroleum Co. of Colombia is drilling a test on its Caraballo concession, south of the Bay of Salamanca. In the northwest, Socony-Vacuum Oil Co. of Colombia is testing its Floresanto concession.

In the lower Magdalena Valley, north and west of the Barco, are five contiguous concessions. From north to south these are San Angel, on which Royal Dutch-Shell is testing No. 3 well and drilling Nos. 4 and 5; El Dificil, on which Cia. de Petroleo "La Estrella" (Shell subsidiary) has found an oil field; Costarica, southwest of El Dificil, but contiguous, which is being tested by Petroleos Ariguani S. A. (Tropical Oil Co.-Colombian capital 50-50) with a drilling well now below 3,500 ft.; El Brillante, due south of El Dificil, on which Shell is drilling a test; and El Retiro, south of El Brillante. Richmond is reported abandoning the El Retiro after testing.

In the middle Magdalena Valley there is a cluster of contiguous con-

cessions. At the north end, on the east and west sides respectively of the river, are El Pedral (Torres Pinzon), and Cantagallo (Cimmitarra), both owned by Socony-Vacuum. Cantagallo has production of 1,000 bbl. daily from three wells, with additional drilling under way; El Pedral is drilling its first test.

On the east side of the river, just south of El Pedral, the huge De Mares concession begins. This concession, producing about 47,000 bbl. daily, is the largest field in Colombia. On the west side of the river, just south of Cantagallo, and opposite the north end of the DeMares, is the Yondo concession, on which Shell's Casabe field is producing about 7,000 bbl. daily. On the east side of the river, and some distance south of the DeMares, the Texas Petroleum Co. has its Teran Guaquaqui fee, privately owned land, where a deep test, 1 Velasquez, was started December 8. The company plans a minimum of three tests on the Teran block which embraces 127,205 hectares (314,000 acres).

In the upper Magdalena Valley, on the west side of the river, and about 150 miles south of the river town of Barranca Bermeja in the DeMares, Richmond is drilling a deep test on its Chorrea (La Dorado) private land lease. In the Llanos, or plains region of southeastern Colombia, Shell is testing two concessions, the San Martin and the Chaffuray.

In October 1944, Compania de Petroleo Shell de Colombia completed its first test on the eastern side of the Andes in the Llanos region. This well, 1 San Martin, was drilled in the San Martin concession to a depth of 3,120 ft., where it was abandoned because of mechanical trouble. The 2 San Martin is now being drilled a short distance from No. 1, where it is reported that oil has been discovered.

Shell subsidiary, Compania Anglo-Colombiana de Petroleo, started operations in March 1945 on its Chaffuray concession with the drilling of 1 Chaffuray. This initial test was abandoned in June 1945 after reaching a depth of 1,750 ft.; well No. 2 was abandoned at 2,190 ft. and No. 3 is being drilled. The Chaffuray test wells are approximately 100 miles from the foothills of the Andes.

The main operating problem involved in this area is the difficulty of transportation across the Andes Mountains. Materials are moved up Magdalena River to the port of Salgar, thence by rail to Bogota. At this point, materials are transferred to trucks for movement along a tortuous mountain highway crossing the cordilleras at 12,000 ft. and dropping down to the Llanos at about 1,500 ft.

Should a producing well be developed in this region, the greatest geological province in South America will be thrown open for intensive exploration and exploitation.

Producing Concessions

The Barco, lying in northeast Colombia, near the Venezuelan border, covers 460,000 acres, and is owned jointly by Socony-Vacuum Oil Co. and The Texas Co., operated by their joint subsidiary, Colombian Petroleum Co. The first oil was discovered in 1933, a pipe line to the coast started in 1937, and the first oil moved to export shipment in 1939.

Barco is in a fairly early exploratory stage insofar as testing all promising structures and possible deeper pays. At present, due to overoptimism about the first field, it has more pipe-line outlet than the connected wells can produce. Its prospective production from proven and semiproven acreage in new fields should rapidly reverse this situation when equipment and manpower are available.

Production or potential production is available from the following fields in the concession: Petrolea North Dome, Carbonera, Rio de Oro, and most promising, Tibu, which was formerly carried as two fields—Tres Bocas and Socuavo. Petrolea North Dome, the first discovery, while not living up to initial expectations, is producing about 11,000 bbl. daily of 46°-gravity oil from about 100 wells on some 4,000 acres, from at least five pay zones in the Cretaceous, at depths ranging from 600 to 3,200 ft.

Tibu is producing about 4,600 bbl. daily of 33°-gravity oil from about 25 wells. At the present time some 25,000 are considered practically proven, and the potential proven area is forecast as high as 80,000 acres. Present production at Tibu is from lenticular sands in the Tertiary, depths averaging about 5,000 ft. Deep-pay possibilities are indicated in the lower Cretaceous by two wells about 8 miles apart, which have found 52°-gravity condensate with large gas volume, with an indicated potential of 500 bbl. per well.

On the extreme north end of the Barco concession, the Rio de Oro field, on a narrow, tight anticline, has a potential production of about 1,000 bbl. daily of 36°-gravity oil from 9 producers out of 13 tests drilled to the 1,500-ft. pay zone in the upper Cretaceous. At present there is no pipe-line outlet for this oil, but with expansion at Tibu, a gathering line will probably be extended north to reach this field.

The Carbonera field lies east of Petrolea South Dome and has three wells good for about 100 bbl. each, from Eocene Tertiary sand at 2,200-3,400 ft. The oil is about 21° gravity and is brought into the main area via pipe line and used for local road building.

A 500-bbl. topping plant is operated on the concession, primarily to supply lease operations. The excess refined products are sold in nearby territory.

The main outlet for Barco crude is through a 263-mile 12-in. pipe line to Covenas on the northern coast of Colombia. This pipe line is operated by South American Gulf Oil Co., which like the concession, is owned 50-50 by Socony-Vacuum and Texas. Present line capacity is 25,000 bbl. daily, which could be increased to 70,000 bbl. by additional pump stations. The line begins in the Petrolea field and runs west and north, reaching a maximum altitude of 5,423 ft. in crossing the mountains.

Lower Magdalena Valley

Cia. de Petroleo "La Estrella" (Shell subsidiary) found production in May 1943 on its El Dificil concession in the lower valley, only about 100 miles from the coastal port of Barranquilla; access to the area, however, has not been easy, involving a river haul of 180 miles from Barranquilla to El Banco, and thence by road for a further 90 miles. At a total depth of 5,950 ft., No. 1 well tested 700,000 cu. ft. of gas and 54 bbl. of 46°-gravity oil through ⅛-in. choke with 2,500-lb. casing pressure. So far seven oil wells have been completed and one dry hole. The potential production is estimated at 3,000 bbl. per day.

For further delineation of this area, another Shell subsidiary, Compania de Petroleo "La Perla" is drilling a third deep test on its San Angel concession just to the north of El Dificil.

Informed geologists in Colombia point to the fact that in almost every respect the Lower Magdalena Valley Basin in Colombia corresponds to the Maracaibo Basin to the east in Venezuela, which is one of the world's most productive basins. El Dificil establishes the petroliferous character of certain horizons in Colombia's Lower Magdalena Valley Basin, and opens up a very important area for active exploration.

Middle Magdalena Valley

Just across the Magdalena River from Tropical Oil Co.'s De Mares concession, Compania de Petroleo "El Condor," a Shell subsidiary, is operating the fast-growing Casabe field.

Casabe is a relatively low-pressure field and pumping equipment is now being installed in some of the weaker wells.

With the exception of a few high points, the entire Casabe field has a lower elevation than the river itself. Consequently, it is swampy and road building is a major prob-

lem. The Condor company is building an extensive dike along the river boundary of the concession to protect the property from the river's overflow. In spite of this expense, the river is nevertheless a distinct advantage to the concession, because all supplies and equipment move in by river boat and thus afford savings over costs of over-land transportation.

For road construction in the field and camp area, much road building equipment is needed, and large quantities of drilling equipment are needed for continued development work which will go forward at a much faster rate now that outlet for the crude is established.

For its operations, Condor has literally carved out of the jungle the location for a very modern camp of all-brick homes and dormitories.

The Casabe field is on Yondo concession No. 26, containing about 118,000 acres. Casabe started shipping oil June 6, 1945, to become Colombia's third field actually shipping oil to market, the others being the Barco and DeMares.

Casabe has about 30 oil wells, and only 1 dry hole. Present production is about 7,000 bbl. daily of 21.5°-gravity oil, most of the production coming from the Tertiary Eocene "C" zone (which is also the main producing zone at DeMares), from depths varying from 3,600 to 7,600 ft., averaging about 4,300 ft. Present wells are drilled on about 50-acre spacing, and only about half are being produced. Oil was discovered in the first test in 1941.

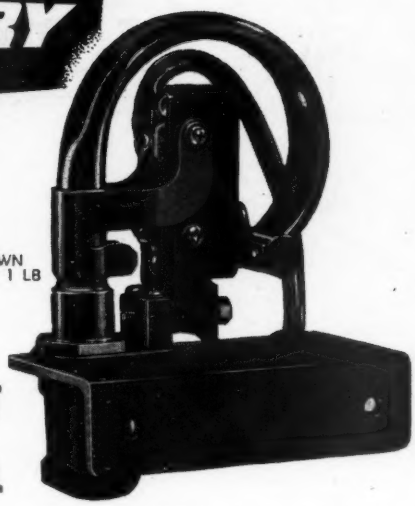
The oil is pumped through 6 miles of 10-in. connecting line to the Andian pipe-line terminal on the DeMares concession, thence to market via Mamonal Terminal near Cartagena on the coast. The price at Mamonal is 86 cents per barrel, netting back about 68 cents per barrel in the field after deducting the government-approved tariffs of 2.9 cents for pumping across river to Andian, 26.8 cents for the pipeline carry to Mamonal, and 1.7 cents loading charge at Mamonal.

Middle Magdalena-DeMares

The DeMares concession, covering 1,250,000 acres, is owned by Tropical Oil Co., an indirect subsidiary of Standard Oil Co. (New Jersey). Oil was discovered in 1918, first export shipment was in 1921. Its present outlet is via Andian Pipe Line Co., owned by the same interests. The Andian is a 335-mile, 10-in. line with 10-in. and 12-in. loops, to Mamonal Terminal, near Cartagena, on the Caribbean Coast. The original pipe line was put in operation in June 1926.

Present production is 47,000 bbl. daily from two fields, La Cira and Infantas, some 40,000 from La Cira, the remainder from Infantas. In ad-

CASE HISTORY



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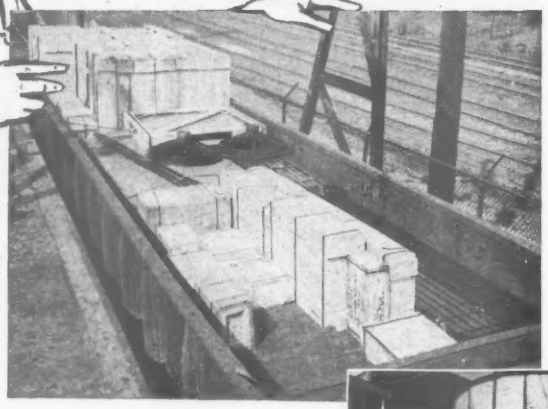

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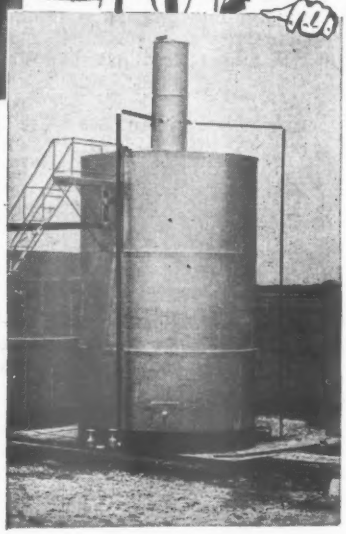

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STAIRWAYS & WALKWAYS

dition a new discovery, Galan, has just been completed in the north end. This is probably a continuation of the Casabe field across the river.

The La Cira field is on a broad anticline about 5 miles long by 4 miles wide, and has several pay zones, but the "C" zone of the Eocene Chorro series is the main pay. The oil is low cold test, asphalt base, gravity 20° to 25°, sulfur content 0.9 per cent. Total proven acreage is about 5,000 and the field is about drilled up. Depth to main pay varies from 2,200 to 4,100 ft., and wells take in about 300 ft. of pay section, about half of which is sand, the balance shale.

The Infantas field is on a sharply folded anticline, about 7 miles long by 1 mile wide. Production is from about the same sands as at La Cira, and the quality of the oil is about the same. This field is also about drilled up.

Five Gasoline Plants

Five natural-gasoline plants are operated in connection with the La Cira and Infantas fields. These plants have a combined capacity of about 70 million cubic feet of gas daily, produce about 2,200 bbl. daily of 8-lb. vapor-pressure natural gasoline, plus about 800 bbl. of propane-butane mixtures. The natural gasoline is pumped to the refinery for blending, the propane-butane mixtures are pumped into the main pipe line to reduce the viscosity of the crude stream. Substantial quantities of the residue gas are returned to the oil sands for repressuring.

The main refinery in Colombia is owned and operated by Tropical on its DeMares concession at Barranca Bermeja, a river port, some 15 miles from the oil fields. This refinery, although it lacks a cracking plant, is otherwise very complete and flexible for meeting the market needs of Colombia. Through use of natural gasoline from the field plants, it is able to blend up a 90-octane aviation gasoline, make a full line of motor fuels, burning oils, diesel oils, lubricants, greases and asphalt. The rated skimming capacity is 21,000 bbl. maximum throughput, but due to an operating schedule designed for manufacture of lubes and other products, the average crude throughput is about 11,000-12,000 bbl. daily.

The outlet for the remainder of the DeMares concession crude is via Andian Pipe Line Co. This, almost completely looped with 10-in. and some 12-in., has nine pump stations, giving it a total capacity varying from 53,000 to 60,000 bbl. daily, depending on the viscosity of the crude.

The main headquarters on the DeMares is at its El Centro camp, which is a small empire in itself.

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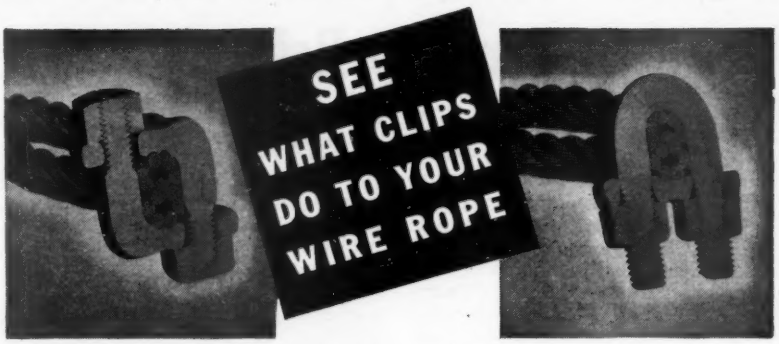

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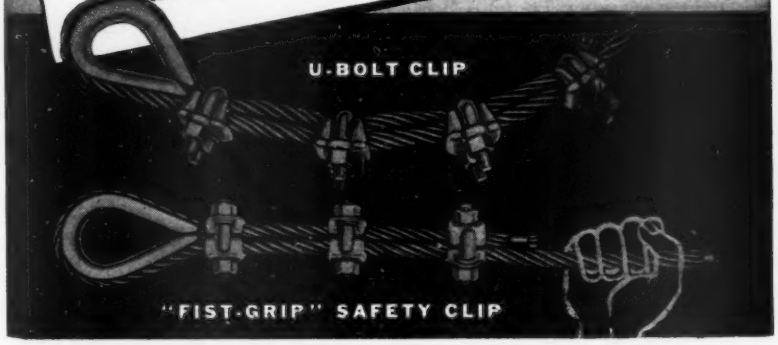

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THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

Sulfide Corrosion Complicates Tank-Cleaning Operation In Tampico Refinery

Here is described how nine 55,000-bbl. badly corroded tanks were cleaned by means of a special-type vacuum tank in less than 3 months after the necessary equipment had been set up.

by Fabian R. Staley

AFTER having spent as long as 6 months in cleaning a single crude-oil storage tank by ordinary methods at the Ciudad Madero refinery near Tampico, Mexico, Petroleos Mexicanos (Pemex) contracted with Eastern Tank Service, Inc., New York, for cleaning nine 55,000-bbl. tanks. They had been used a number of years for storing Poza Rica crude, which has an average sulfur content of 1.80 per cent, and the steel roofs had been largely destroyed by sulfide corrosion so that large sections had fallen into the tanks. Consequently the oil contained large pieces of scale and rust as well as sand and water. The tanks involved contained approximately 210,000 bbl. of oil with an average water content of 16 per cent. The tank sediment was very viscous and could not be handled by regular pumping equipment.

The nine tanks were thoroughly cleaned by means of a special-type vacuum pump in less than 3 months after the necessary equipment had been set up. Over 180,000 bbl. of oil, suitable for cracking plant charging stock after Tretolite treatment, was recovered from these tanks. Before starting the cleaning operation, all of the remaining roof plates were removed from the top of the tanks as a safety measure. A boarded pit, about 5 by 5 by 5 ft., was prepared beside the manhole of the tank. The bolts around the manhole plate were then loosened and the low-viscosity liquid was permitted to flow out at a rate that would not overflow the pit. After all of the liquid that would flow out of the tank had been transferred, the plate was removed from the manhole and the vacuum pump set up to take suction on the heavy, viscous sediment remaining in the tank. See Fig. 1.

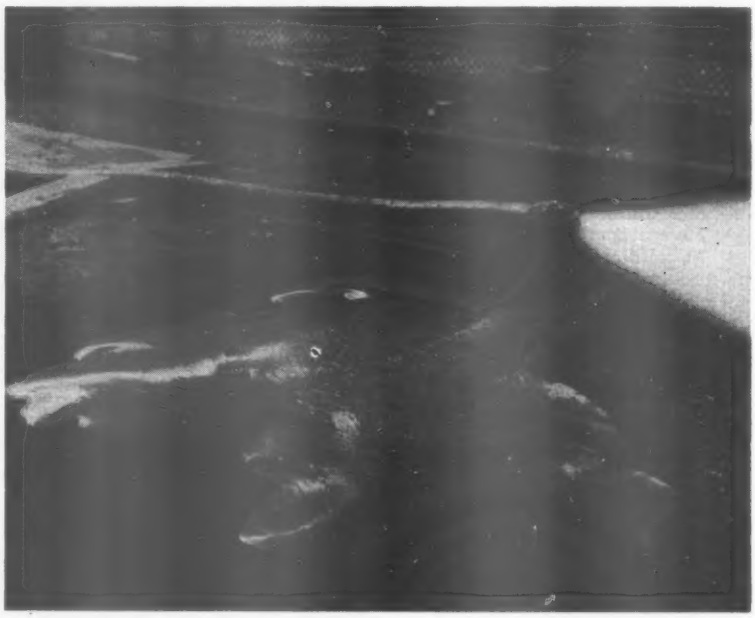


Fig. 2—The special patented vacuum pump emulsifies the heaviest sludge, and the removal of any kind of bottom sediment from oil tanks can be accomplished in a remarkably short time

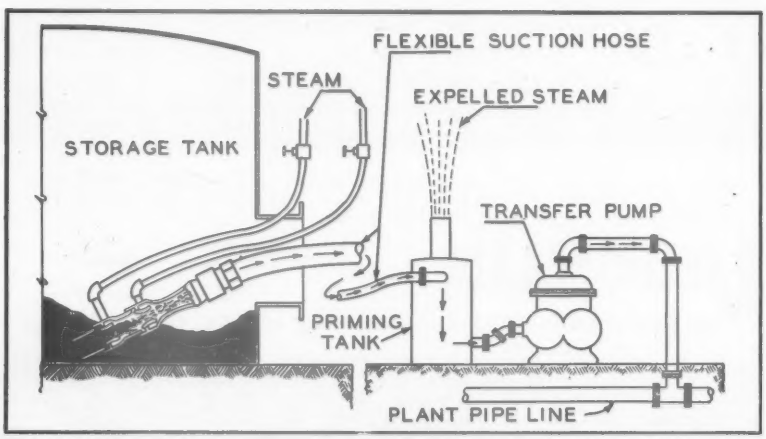


Fig. 1—Schematic diagram of the vacuum-pump operation

Steam is admitted to the pump at about 100 psi. creating an annular jet of approximately 3,000 ft. per second velocity at the venturi throat. This high velocity creates a vacuum within the pump into which the sludge is drawn, and when it contacts the steam jets it is heated and atomized in such a way as to render it completely fluid.

The hot liquefied sludge was delivered by the pump, through a 4-in. flexible bronze hose, to a small priming tank in which it was given a Tretolite application. The treated oil was then pumped without any difficulty by an ordinary transfer pump to the cracking plant, where it was used as charging stock. All of the sediment was removed from the tanks, and the bottoms left entirely clean.

War's End Brings Accelerated Activity In Yumen, China's Only Oil Field

*by K. C. Lu**

THE Yumen oil field in the Kansu Province is the only commercially productive field in China, and its discovery in 1939 was the result of an exploration and development program undertaken to partially relieve serious wartime shortages of petroleum products.

The field is in the northwestern part of China, 2,000 miles from the coast and 450 miles from Lanchow, capital of Kansu Province. It is approximately 8,200 ft. above sea level and located in an isolated area of the northern flanks of the Chihlienshan range of mountains and the southern edge of the Gobi Desert.

*Petroleum engineer of Kansu Petroleum Production and Refining Administration, now trainee in the United States.

History

The Japanese invasion of the China coast early in the war cut off all Chinese ports and created a serious shortage of the petroleum products so urgently needed by China in military operations. As a result, in 1939, the National Resources Commission of the Ministry of Economic Affairs of China organized a prospecting party to drill a test well near the oil seepages in the bed of the Shihyouho River, meaning "Petroleum River" or "Rock Oil River." In the latter part of 1939, the test well was completed as a pumper at 500 ft., and in 1941, a deeper test, the No. 4 well, drilled to 1,430 ft. where it encountered an oil sand and came in flowing out of control, definitely establishing the presence of a major field. The proving of the field was followed in March, 1941, by the announcement of the organization of the Kansu Petroleum Production and Refining Administration under the direction of Y. C. Sun. Main offices were set up in Chunking and operational offices were located in the field.

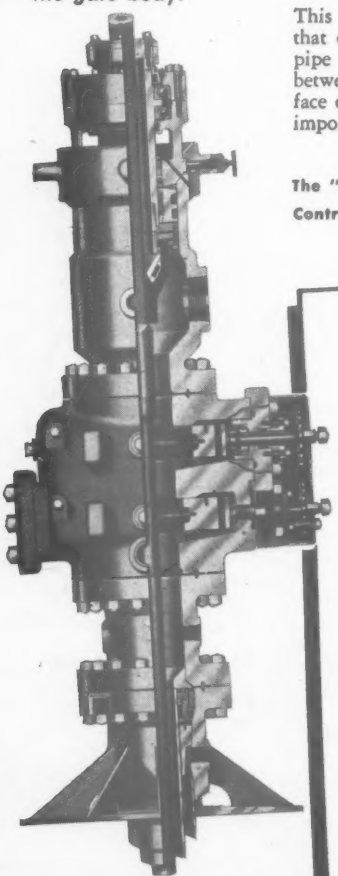
Drilling rigs and production equipment as well as refining units were ordered from the United States, but, due to the war with Japan, only a small percentage of the material reached the field via the Burma Road. With the equipment that did reach the field, development progressed slowly but steadily until late 1943 when small amounts of sup-

Map showing relative position of Yumen oil field in China

Watch THESE SHAFFER RAMS CLOSE

See how Shaffer's "Floating" Ram is engineered for friction-free closing and tighter pack-off!

ONE OF THE MANY advanced features engineered into Shaffer Gates is the Shaffer "Floating" Ram—a ram that utilizes rubber "flow" to assure positive, complete and unusually friction-free closing of Shaffer Cellar Control Gates against even the highest well pressures. As outlined in the accompanying illustrations, you will note that in the Shaffer Gate the rams seal off around the pipe *first*. Then—and only then—is the one-piece ram rubber squeezed backward and upward to form a tight seal between the ram and the upper inside face of the gate body.



The Shaffer Double Gate in combination with the Shaffer Combination Rotating Blow-Out Preventer and Stripper (top) and Shaffer Base.

This unique Shaffer feature—that of closing off around the pipe first and *then* sealing off between the ram and the inside face of the gate—is one of the important reasons why Shaffer Gates give such effective pack-off in any emergency. It insures two important advantages...

1. That there is no pack-off—therefore no friction or wear—between the rams and gate body until *after* the rams are completely closed and tightly packed around the pipe. Rams not having this exclusive Shaffer feature develop friction of the packing when opening and closing the gate. This friction could prevent the rams from fully closing, thus permitting leakage around the pipe and jeopardizing the safety of the well. But such risks are eliminated with the friction-free action of Shaffer "Floating" Rams!

2. By utilizing "squeeze" against the one-piece ram rubber to seal off against the inside face of the gate body, not only is a more complete and positive closing assured, but also quicker and easier *opening* of the gate when the emergency is over. As mechanical force against the rams is released, the first action that occurs is for the rubber to contract to its original shape. Thus it *automatically* pulls away from the gate body to eliminate any friction or drag as the rams are opened. This means smooth and easy opening!

The "Floating" Ram is another of the many engineering advancements that make Shaffer Cellar Control Gates the safest and most efficient pressure control equipment you can install on your wells!

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MAXIMUM COMPACTNESS The Shaffer Double Control Gate is so unusually compact that it combines two control gates... the upper for closing around the drill pipe—the lower for closing off open hole... in as little vertical space as 23 inches!

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These and other Shaffer-engineered advancements make these Gates so unusually efficient for modern well control operations. Get all the facts on Shaffer Cellar Control Equipment by contacting your nearest Shaffer representative. Or write direct for complete details!

plies began to arrive by air from India. However, these were far from the amounts needed to meet the actual development and operational requirements.

Development was also made extraordinarily difficult because food and daily necessities of the employes had to be brought in from distant points without adequate transportation, and few facilities were available for removing the refined products from the area.

Since end of the war, however, considerable expansion of the production and refining capacity of the field has been initiated, and plans have been made for immediate construction of refinery and trunk pipe lines. Also, extensive exploration of the entire area has been planned.

Geology

Production in the Yumen field comes from two sands of Cretaceous age known as the "K" and "L" sands, which are at depths of approximately 500 ft. and 1,500 ft., respectively. These sands are loose and medium grained with high porosity and an average thickness of about 150 ft. Active seepages occur at the foot of a high cliff which is the result of erosion where the Shihyouho River cut across the structure and at an outcrop 2 miles east of the river. The existence of these seepages has been known for over 2,000 years and is responsible for the early interest shown in the area.

The surface of the entire area is covered by sand and gravel ranging in thickness from 150 ft. to 300 ft. The producing formation is overlain by a series of red beds, but actual subsurface conditions are unknown since seismic and exploration instruments have been unavailable. However, recent drilling has proved the structure to be fairly uniform and symmetric. No dry holes have yet been drilled in the area.

Drilling Operations

Current drilling operations are confined to three active rotary rigs. All rigs are powered by diesel engines which operate on fuel from the refining plant in the field area. A few of the derricks in use in the field are 80-ft., K-type derricks, while the remainder were made from salvaged iron angles formerly used in bridge building. Semiportable rotary drilling rigs are used in completing the wells.

Depths of wells vary according to the period in which they were drilled. During the first period, 1939 to 1941, seven wells were drilled with cable tools and completed at an average depth of 550 ft. as pumping wells. During the period 1942 to 1945, 18 were drilled with rotary rigs and completed as flowing wells. Deeper testing has been under way since early in 1945 and a depth of 3,000 ft. has been reached. Although several lower oil sands have been encountered, none of the deeper wells has been completed.

Casing program in general consists of 250 ft. of 11¾-in. pipe as surface string and 1,500 ft. of 7-in. pipe as oil string. Flow line in most of the wells is 2½-in. tubing. The surface string is cemented at the surface while the oil string, owing to the shortage of cement, is cemented only along the bottom 700 ft. of pipe. In completion, the oil string is set as low in the caprock as practicable, usually about 50 ft. above the top of the producing formation. The well is then drilled through the producing sand with heavy mud. After the tools are pulled, 4½-in. liners are set, tubing and christmas tree are installed, and the heavy mud is displaced with water or oil to bring the well into production.

Usual requirements for one well are three rock bits and five drag bits, since formations in this area are comparatively soft. Base mud material is fire-clay, which is available locally. Barite for heavier muds must be brought in by trucks from Kweichow Province, 2,000 miles from the field.

Production Practices

Initial casing and tubing pressures are about 800 psi. and flow rates are controlled by chokes which vary in size from ⅛ in. to ⅞ in. The crude is an intermediate paraffin base oil of approximately 33° A.P.I. gravity with a 50° F. pour point and very low sulfur content. It is delivered from the wells to a treating unit which consists of two wooden tanks with heating coils. This unit is used for sand settling and pressure relief. Since no separators are available, no gas is recovered from the crude. From the settling unit, the oil is delivered by means of gravity flow to a pumping station and thence, through a 4½-in. pipe line to the refinery.

Daily crude production from all wells is adjusted to meet the refinery requirement and averages from 1,500 to 2,200 bbl. The high pour point of the crude, combined with the average low atmospheric temperature at the field, causes considerable wax deposition in the well tubing and requires that all tanks be steam heated and gathering systems and transportation lines to the refinery be steam traced. Frequent swabbing of all wells, particularly during the winter, is necessary.

Refining

The refining plant in the Yumen field was built under serious difficulties of material shortage and consists of several topping batteries, a pipe still, and several products storage tanks. The pipe still is made up partly of material obtained in various parts of China and partly of materials brought in before severance of the Burma Road in 1942. A 1,500-bbl. thermal cracking plant is now under construction at the refinery and is scheduled to be completed by the end of 1945. Plans are also under way for enlargement and modernization of the plant.

The Yumen crude yields about 21 per cent of straightrun, high-octane gasoline, together with kerosene, diesel oil, wax and a large amount of residual oil. The kerosene has had many varied uses in China during the war; the diesel oil is used largely as fuel, and the wax is used in the manufacture of candles. The thousands of tons of residual oil, because of transportation difficulties, no market, and no facilities for further refining, is used only for fuel and heating purposes.

Other Operations

The field headquarters and several residential areas are located within the field. Sufficient houses, stores and commissaries have been built to care for all of the 7,000 employes. Additional necessities such as a flour mill, brick works, schools and hospitals have also been added. Water is pumped by diesel-powered pumps from the river 300 ft. below the operating area, and electricity for lighting and small power supplies is furnished by two diesel-powered generators. Since all supplies must be obtained from distant sources with poor transportation facilities, extensive workshops and warehouses are also maintained.

All development in the Yumen field has been carried out under serious handicaps, but the perseverance of the Kansu Petroleum Production and Refining Administration has made the operation a success and paved the way for additional exploration and development throughout China.

BOOKS

TABLES FOR MEASUREMENT OF OIL. Produced by Measurement and Sampling Subcommittee of the Institute of Petroleum, London. 320 pp., $6.00.

This book has been prepared to meet the needs of the petroleum industry for authoritative tables for use in computing oil quantities in territories which employ the British (Imperial) system of weights and measures. Although countries using the United States system of weights and measures have the official Bureau of Standards Circular C 410 as a standard, no such official guidance has been available in territories adhering to the British system.

The work can, therefore, be regarded as the official British counterpart of the American publication "National Standard Petroleum Oil Tables — Circular C 410." The main tables contained in Circular C 410 have been recalculated to allow entry to be made with specific gravity instead of A.P.I. gravity, and they have been supplemented with additional tables.

Demand for Venezuelan Oils in 1945 Supplied Despite Complications

(Continued from page 224)

August, is in the State of Anzoategui in the Greater Oficina area, approximately 15 km. northwest of the Oficina field and is drilling at 7,947 ft.

The construction of a new divisional headquarters in eastern Venezuela has been prosecuted throughout the year at a point called Anaco, some 5 km. north of the provisional Guario camp and approximately 99 km. from Puerto La Cruz. Construction of this camp is continuing into 1946. The project envisions a modern camp with permanent housing facilities both for staff and labor, hospital, warehouses, shops, etc. Smaller but also permanent facilities are being provided at Guico.

Present field headquarters for the company's western llanos operations consist of company-constructed facilities a few kilometers outside of the town of Barinas, where a limited number of living quarters, a field office, warehouse and garage facilities have been constructed over the past 2 years. A small but modern field hospital is also under construction and will be ready for occupancy early in 1946. The lack of highways and relative isolation of the area has presented major problems in transportation and supply. River transportation is used from June until November and overland routes are utilized during the dry season. The transportation of personnel to and from Barinas is almost exclusively by airplane with many items of supply going in by the same method. The company has opened various air strips at strategic points in the area, and airplane transportation is almost exclusively utilized in provisioning and staffing field parties out of Barinas.

Compania Consolidada de Petroleo, S.A. (Sinclair)

Consolidada operates and has production only in sole-owned Santa Barbara and Muri fields. During the first 10 months, 52 wells were drilled in these two fields, all producers. In comparison with this figure, 43 wells were drilled in 1944, and 40 were producers. The other three were gas wells.

The company has drilled no wildcats during the year.

DAILY AVERAGE PRODUCTION OF COMPANIA CONSOLIDADA DE PETROLEO, S.A. (SINCLAIR) BY MONTHS FOR 1945

Month—	Bbl. dly.
January	27,868
February	27,337
March	27,049
April	26,476
May	28,423
June	27,577
July	30,388
August	30,850
September	27,866
October	25,993

Texas Petroleum Co.

In far eastern Venezuela, The Texas Petroleum Co. is drilling 6 Delta Amacuro in the vicinity of Tucupita. The company drilled well No. 2 in October 1944 as the first test in the area and it was a dry hole. Well No. 1, completed in May of this year, was a producer. Nos. 3, 4 and 5 have also been completed during the year, but it is not generally known whether they were producers or dry holes. Completion information is held confidential by the company.

Two development wells were completed during the year in the Santa Ana (Rincon Largo) field, both producers.

DAILY AVERAGE PRODUCTION BY TEXAS PETROLEUM CO. BY MONTHS FOR 1945

Month—	Bbl. dly.
January	1,453
February	1,331
March	2,011
April	1,376
May	1,451
June	1,341
July	1,510
August	2,558
September	2,506

Fields: Caritos, Santa Ana (Rincon), Tucupita.

S.A.P. Las Mercedes

S.A.P. Las Mercedes (Texas Petroleum and Caracas Petroleum) recently started drilling operations on two wells, 1 Grico, in Guarico, 10 km. north 30° west of El Punzon and 2 Camaz, in southern Aragua. Location has been made for 1 Camaz, a mountain front test. Drilling of this well has been delayed until the end of the rainy season. Manapire 2, 51 km. south and 28° east of Las Mercedes in southern Guarico, was abandoned last January as a dry hole.

The company has completed 12 development wells in the Las Mercedes field, all of which have been producers except one. Three field wells are currently drilling.

All of the field wells are shut in at the present time with the exception of small withdrawals for lease operation and road oil. No shipping outlet has been provided for this field because of its isolation from existing pipe lines.

DAILY AVERAGE PRODUCTION BY S.A.P. LAS MERCEDES BY MONTHS FOR 1945

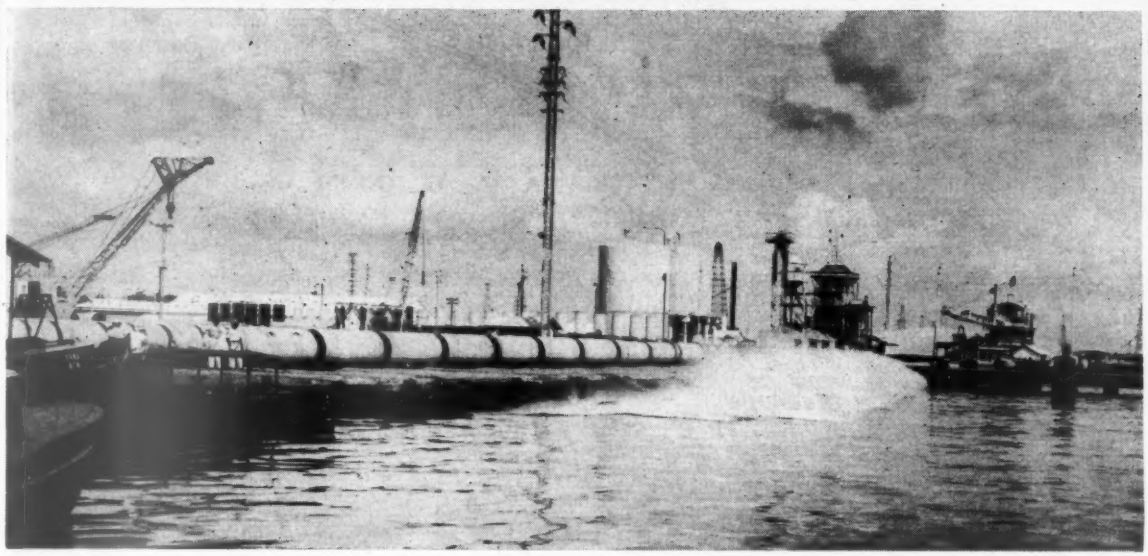
Month—	Bbl. dly.
January	....
February	18
March	75
April	122
May	121
June	....
July	....
August	....
September	....
October	....

Field: Las Mercedes.

Venezuelan Atlantic Refining Co.

The Venezuelan Atlantic, which last year completed negotiations for operating interest in concessions of Pantepec Oil Co. of Venezuela, is currently drilling three exploratory wells in western Monagas, in the vicinity of the Santa Barbara, Muri

Laborers' camp at Jusepin



Launching caissons for towing to location on Lake Maracaibo

and Mulata fields. All of the wells were spudded in September and October. San Pedro 1, 14 km. south and 12 west of Maturin, is now at 6,436 ft. Hueso 1, 15 km. south and 28 west of Maturin, is drilling at 5,625 ft. Tonoro 1, 22 km. south and 68 km. west of Maturin, is drilling at 2,744 ft.

Three other wildcats, and 2 Morichito and 1 Punta Gorda in the same general area, have been abandoned recently as dry holes.

Avipa 1, also in the same general region, called the Pirital area, adjoining Travieso Lot 3 on the west, was completed at 4,818 ft. for a small producer. Since last May its production has averaged about 125 bbl. per day.

Richmond Exploration Co. (Standard of California Subsidiary)

Richmond Exploration Co. is drilling at 7,100 ft. at 1 Montanita, northeast of the town of Pedregal in the State of Falcon. Zulia 1, 25 km. south 20° west of Maracaibo in the State of Zulia, is drilling at 3,300 ft.

Orinoco Oil Co., S.A. (Pure)

The Orinoco company is drilling 2 Calentura, a wildcat 22 km. north and 43 west of the town of Maracaibo in the State of Zulia. The well is currently drilling at 9,872 ft.

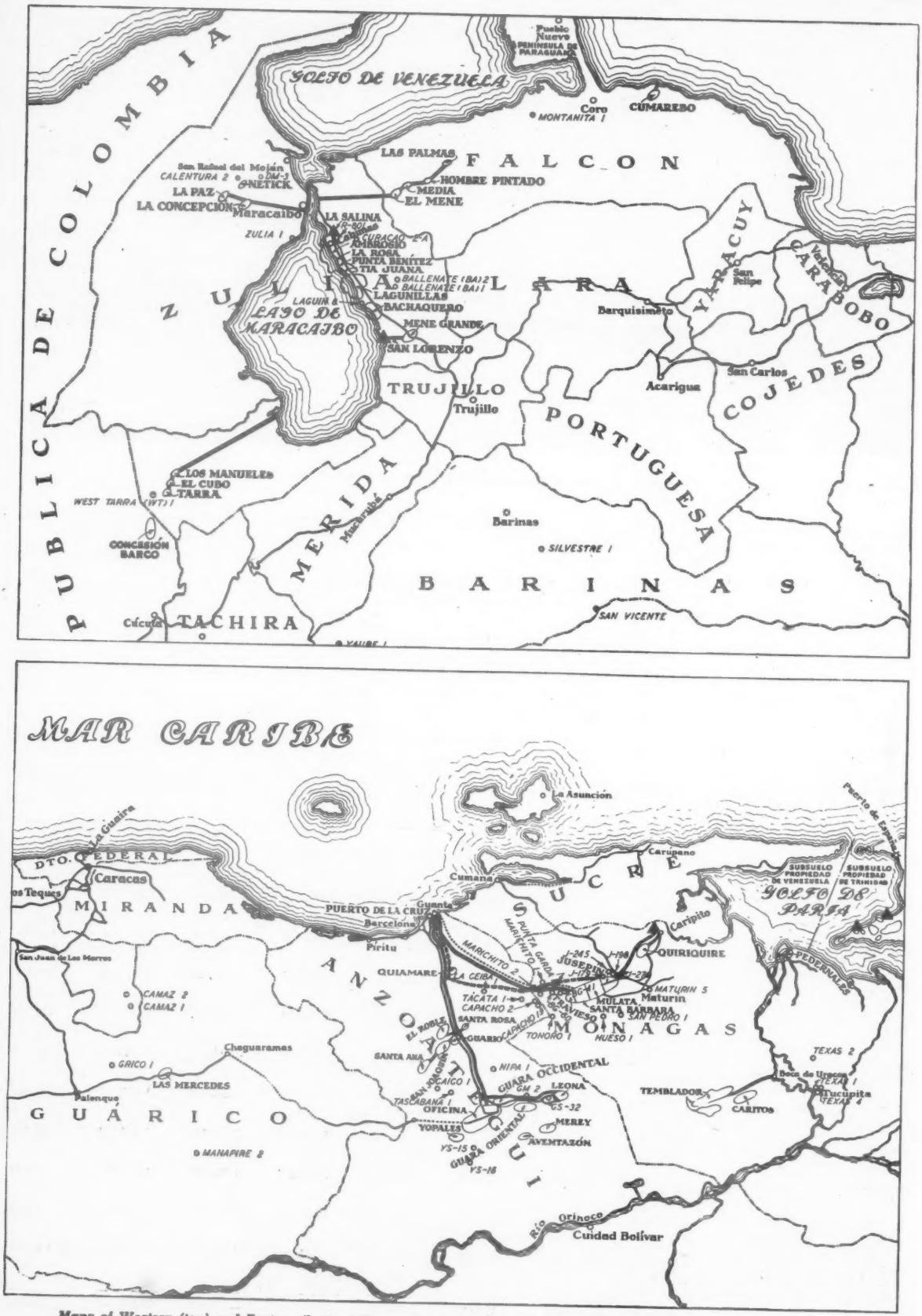
DAILY AVERAGE PRODUCTION BY ORINOCO OIL CO., S.A., BY MONTHS FOR 1945

Month—	Bbl. dly.
January	...
February	...
March	521
April	588
May	554
June	509
July	473
August	441
September	419
October	...

Field: Netick.

PRODUCTION OF IMPORTANT FIELDS BY MONTHS—1945

	Lagunillas	Jusepin	Mulata	Travieso	Guara	Quiriquire	Oficina	Leona
January	2,071,275 4,360,957 612,837	652,224	819,151	52,874	1,453,775	993,389	1,377,127	116,532
February	1,875,392 3,884,514 556,517	1,128,395	758,938	126,858	1,241,380	915,683	1,272,599	125,500
March	2,352,398 4,894,702 553,193	1,506,314	1,015,539	218,654	1,495,566	643,488	1,419,428	148,823
April	2,318,684 5,132,470 509,706	1,525,488	974,557	233,423	1,441,305	703,492	1,313,252	115,942
May	2,388,451 5,249,500 610,814	1,596,171	1,005,144	247,189	1,202,655	910,811	1,307,869	86,999
June	2,276,562 4,431,214 544,774	1,556,028	946,907	270,031	1,346,500	1,422,859	1,267,850	2,407
July	2,368,544 5,868,039 545,691	1,690,254	945,572	301,835	1,655,050	1,514,853	1,258,852	48,423
August	2,345,209 5,867,826 466,984	1,699,350	926,886	318,175	1,702,545	1,589,516	1,321,045	72,494
September	2,225,841 5,454,665 492,732	1,580,954	882,212	335,276	1,552,384	1,036,702	1,192,377	15,925
October	2,264,624 6,328,626 553,802	1,706,128	897,679	402,082	1,591,183	1,612,064	1,186,104	closed down
Total	79,406,542	14,642,306	9,172,585	2,506,396	14,682,344	11,342,856	12,916,503	733,042



Maps of Western (top) and Eastern (bottom) Venezuela showing locations of exploratory wells drilled during 1945

Venezuela's 1946 Exploratory Program Biggest in History

THE exploratory program for 1946, if not altered by some unforeseen factor, will be the most intensive in history.

The 1943 oil law requires operators to evaluate exploratory concessions and a minimum of one-half of the concessionary acreage must be relinquished to the government at the end of a 3-year period from the date on which the concessions were granted. This comparatively short exploratory period is one of the primary reasons for the intense exploration programs that the companies must follow in order to select most attractive acreage for further exploration and development. In general, all companies must select their acreage by late 1947 and early 1948. This selection of acreage or "parcelization" also requires surface mapping of the areas in order to prepare topographic maps. Topographic maps must be presented to the government on each parcel retained.

The scope of geophysical exploration was on a greater scale in 1945 than at any time in the past. The evaluation and parcelization of exploratory concessions require the use of geophysics, regardless of cost or difficulty of the area in which the crews are working. Reconnaissance work must be done in the 3-year period which will end in 1947-48, in order to select the areas which appear most promising. After this selection has been made, localization of the more desirable areas must be made for eventual test by drilling.

In 1945, the companies operated throughout the year a total of 27 seismograph and 9 gravity meter parties. Nineteen of the seismograph parties were scattered in eastern Venezuela in the states of Guarico, Anzoategui and Monagas, with one party placed in extreme eastern Venezuela in the Delta Amacuro region. Fourteen surface geological parties have been concentrated in western Venezuela in the state of Zulia and in eastern Venezuela in the active areas of Guarico, Anzoategui and Monagas.

Active in Two Concessions

Creole is actively engaged in exploration work on two concessions in the State of Guarico. The first concession, called the Barbacoas block, east of the town of El Sombrero, comprises approximately 120,000 hectares (296,400 acres) of land. The second large block, east of the Barbacoas concession, is called the Tamanaco block and is in the vicinity of Altagracia de Orituco, and comprises approximately 150,000 hectares (370,500 acres). Intensive exploration activity in these two areas has proceeded in 1945 and will be augmented in 1946.

Creole has had two seismograph crews working in the Barbacoas block, and another started in November. Two gravity meter and two surface-geological parties also have been active in the same area. Exploration work will be first intensified in the Barbacoas block.

In December, Creole started slim-hole drilling in the area. Plans have been made for 30 slim holes to an average depth of 5,000 ft. to evaluate and verify information indicated by seismograph, gravity-meter and surface parties. A considerable amount of photo-geological work has been done as well as photogrammatic work. Excellent maps have been made from photogrammatic photographs.

In addition to parcelization of the Guarico concessions, under the 1943 oil law, Creole also has to parcel 120,000 hectares in the Lake Maracaibo area, and a large block in northern Monagas in eastern Venezuela by late 1947 and early 1948.

Creole has drilled six geological exploratory tests in the area north of its important Jusepin field. The wells have been drilled at 2-kilometer intervals northwest from the northeastern part of the field; the most northerly test is approximately 14 kilometers from the northeastern boundary of the field.

Tests have also been drilled in scattered locations in the Capacho area in northeastern Anzoategui near the Monagas boundary line. These tests have been spaced 1 kilometer apart to the north and west of the discovery well, 1 Capacho.

Jusepin-Puerto la Cruz road and pipe line

We are twenty years old

Model O twin-engine draw works for drilling to 8,000 feet with 4½" drill pipe.

Model Q, H, K or S single drum servicing hoist for wells 2,000 to 12,000 feet.

Model S single drum draw works for drilling to 4,500 feet with 4½" drill pipe, or workover jobs to 10,000 feet.

Model E twin-engine draw works for drilling to 6,000 feet with 4½" drill pipe, or workover jobs to 12,000 feet.

In addition, seven other geological tests have been drilled in this immediate area, located in a straight line due north of Capacho.

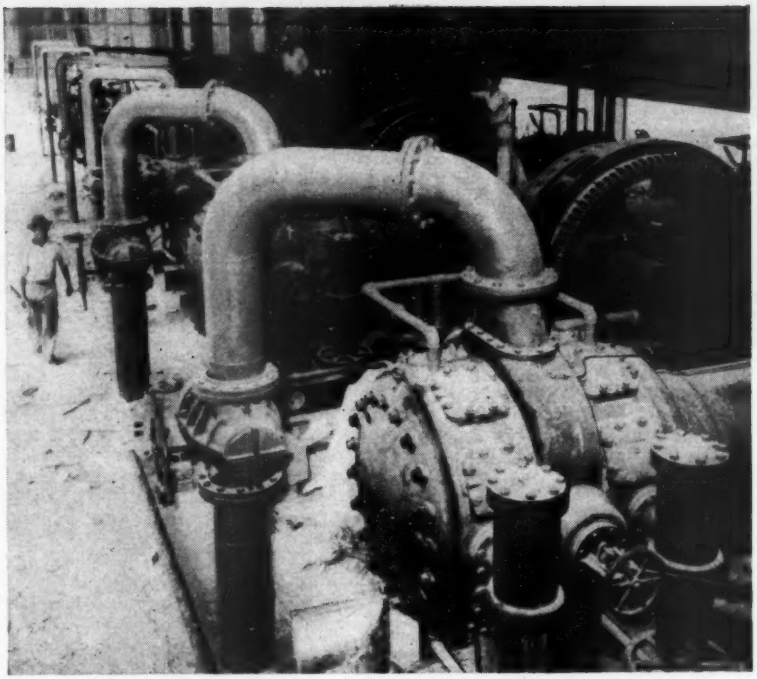
Still another exploratory test was located 5 kilometers south of the Quiriquire field.

The largest exploration budget in the history of Creole has been scheduled for 1946. In addition to the 30 slim holes to be drilled in Guarico, the company plans to drill 40 wildcats in eastern Venezuela and from 12 to 15 wildcats in western Venezuela.

The Shell Group, composed of three operating companies, Venezuelan Oil Concessions, The Caribbean Petroleum Co. and Colon Development Co., has had the largest exploration program during the past year of all companies.

Currently, Shell has five seismograph parties in operation. Four of these parties have been active throughout the year; two working in northern Anzoategui, one in Guarico and one in the district of Mara, Zulia.

In addition to these four parties, a new seismograph crew started work in September in the district of Miranda, Zulia.



A new compressor station under construction at Quiriquire

Eastern Holdings

The eastern Venezuelan holdings on which the company has concentrated much of its seismograph activity is a large exploration block in northern Anzoategui and eastern Guarico. The block extends from the town of Clarines in northern Anzoategui, west to San Jose de Guaribe, east to Aragua de Barcelona and south to the town of San Jose de Unare. Eighty per cent of this block is in the State of Anzoategui, and 20 per cent is in Guarico.

In addition, two gravity meter parties have been in operation. The first party has worked throughout the year in the districts of Mara, Colon and Paez in the State of Zulia. This party has done some gravity work on submerged holdings in addition to land surveys. The second party started work last July in the district of Miranda, Zulia.

Two surface geological parties are now active in eastern Venezuela in Anzoategui and Guarico, and a third party is working in the District of Colon, Zulia, after having completed an assignment in western Venezuela in the Bolivar district, east of the Bolivar coastal fields of the Lake Maracaibo region.

The company also has done limited structural drilling in western Venezuela in the district of Colon, Zulia.

Mene Grande has worked two seismograph parties in the districts of Aragua and Freites in the State of Anzoategui, an area north and west of Oficina. Two gravity meter parties also have been in operation. The first party had various assignments. During the early part of the year it was working in the western llanos in the State of Apure, where Meneg has a large exploratory concession south of the Apure River. After completion of this work the crew was moved to western Venezuela where it completed a short as-

ALLOCATION OF EXPLORATION PARTIES (BY COMPANIES) FOR 1945 IN EASTERN VENEZUELA

Shell

2 seismograph parties—northern Anzoategui.
1 seismograph party—Guarico.
2 geological parties—Anzoategui and Guarico.

Creole

3 seismograph parties—Guarico.
2 gravity meter parties—Guarico.
2 geological parties—Guarico.

Meneg

2 seismograph parties—Anzoategui.
1 geological party—Guarico.

Consolidada

2 seismograph parties—central Monagas.
1 geological party—Monagas (this party has also worked in Barinas).

S.A.P. Las Mercedes

4 seismograph parties—Guarico and eastern Monagas.
1 geological party—Guarico and southern Aragua.

Socony

1 seismograph party — Guarico and Anzoategui.
1 geological party—Monagas.

Atlantic

1 seismograph party—Anzoategui.
1 seismograph party—Guarico.
1 seismograph party—Monagas.
1 gravity meter party—Guarico.
1 geological party—Guarico.

Richmond

1 seismograph party—Delta Amacuro.

Total eastern Venezuela: 19 seismograph parties, 3 gravity meter parties, 9 surface geological parties.

ALLOCATION OF EXPLORATION PARTIES (BY COMPANIES) FOR 1945 IN WESTERN VENEZUELA

Shell

1 seismograph party—District of Mara, Zulia.
1 seismograph party—District of Miranda, Zulia.
1 gravity meter party—Districts of Mara, Colon, Paez in Zulia.
1 gravity meter party—District of Miranda, Zulia.
1 geological party—District of Colon, Zulia.

Creole

No parties.

Meneg

1 gravity meter party—Apure and Zulia.
1 gravity meter party—Zulia (south of Mene Grande field).
1 geological party—Zulia (for short assignment).

Consolidada

1 seismograph party—Barinas.

S.A.P. Las Mercedes

No parties.

Socony

3 seismograph parties—Barinas.
1 gravity meter party—Barinas.
1 geological party—Barinas.

Atlantic

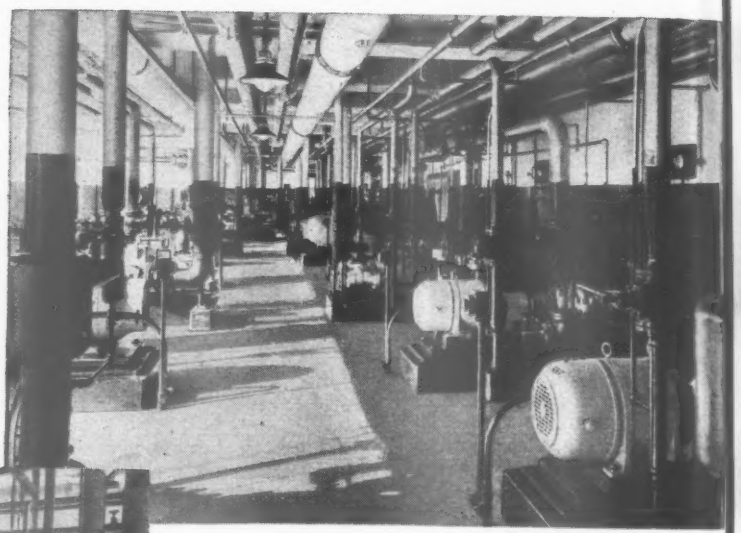
No parties.

Richmond

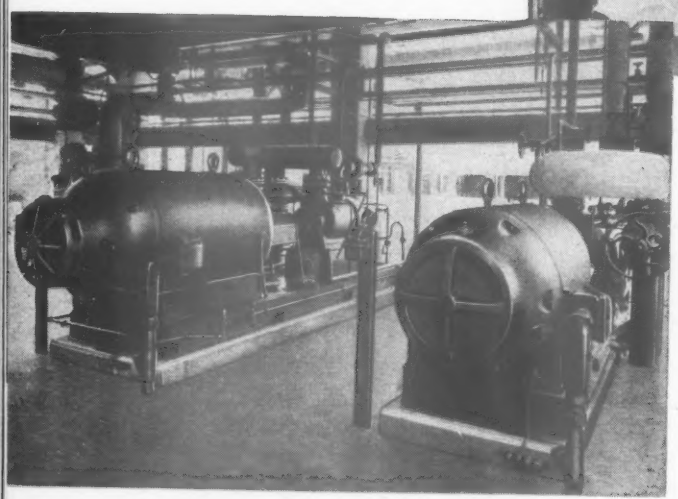
2 seismograph parties—Zulia.
1 gravity meter party—Zulia.
2 geological parties—Falcon and Zulia.

Total western Venezuela: 8 seismograph parties, 6 gravity meter parties, 5 geological parties.

You don't fence 'em in...



Main pump room in a refinery. The pumps are driven by G-E totally enclosed, fan-cooled, squirrel-cage induction motors ranging in size from 25 hp to 250 hp, 3000 rpm.



Tutwiler Refinery of the Cities Service Oil Company at Lake Charles, La.—Two large, totally enclosed, fan-cooled, explosion-proof, squirrel-cage induction motors, each coupled to a centrifugal pump. The motor at the left is a 600-hp, 3600-rpm Type K, and the one at the right is a 500-hp, 3600-rpm Type K-6339Z.

GE

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signment in the District of Mara, Zulia. From there the party was moved to the southwestern Zulia exploration block, where both land and under-water surveys were made. The second gravity party has been started recently and is now surveying a concession block south of the Mene Grande field.

Surface geological work has been done in northern Guarico with a small party active there throughout the year, making regional studies. Another surface party recently completed a short assignment in southwestern Zulia.

The company has carried on an active structural-drilling program in the Greater Oficina area, around San Tome, Oficina and Leona, and in the southern part of the District of Aragua and the northern part of the District of Freites and the Santa Barbara area, north of Oficina.

Geophysical work will be increased in 1946. Meneg plans extensive wildcat drilling both in eastern and western Venezuela. Both seismograph and structural-drill work will be continued in Anzoategui, from Oficina north. Seismograph, gravity meter and magnetometer work will be conducted in the Apure exploration block and on the southwest Zulia block.

Consolidada has engaged three seismograph parties during the year, two of which have been in central Monagas and the third in the llanos, State of Barinas. One geological field party was active on various assignments both in eastern and western Venezuela.

S.A.P. Las Mercedes had four seismograph parties in Guarico and eastern Monagas, in an area adjacent to the Delta Amacuro, and one geological field party worked in the vicinity of the Mercedes field and at scattered points in northern Guarico and southern Aragua.

Socony-Vacuum has large exploratory concessions of roughly 1,500,000 hectares in the western llanos in the states of Barinas and Apure. The company has pursued an intensive geophysical exploration program in Barinas during the year, operating up to five seismograph parties and one gravity meter crew, as the seasons permitted. Currently three reflection parties are working in the area and one geological party is stationed in the vicinity of Santa Barbara. Still further intensification of the exploration program on the large block of western Venezuelan holdings is contemplated for 1946.

Other Exploratory Work

In addition to the work in Barinas, geological and geophysical exploration was also made in the states of Monagas and Guarico in eastern Venezuela. One reflection party has been active in Guarico and Anzoategui throughout the year. One geological party worked in northern Monagas from May until September. Socony has drilled 23 structural tests for geological exploration with a Failing-66 rig to an average depth of 2,700 ft. These tests have been located in the Guico area in eastern Anzoategui.

Exploration of the Monagas holdings will also be increased in 1946.

Atlantic is operating one seismograph party in the State of Monagas; one seismograph party in the State of Anzoategui; one seismograph party, one gravity meter and one surface-geological party in the State of Guarico.

Richmond has two seismograph parties and one gravity meter crew in Zulia on the west side of Lake Maracaibo in the districts of Perija and Urdaneta. Two geological parties are working in the states of Falcon and Zulia, the latter in the area of 1 Zulia wildcat which was recently spudded. In far eastern Venezuela, one seismograph party is located in the Delta Amacuro.

New Refinery Construction Under Way and Projected in Venezuela

IN compliance with the Venezuela oil law of 1943 which requires foreign companies to refine a fixed percentage of Venezuelan crude within the country, Creole made plans in 1945 to build a modern refinery with a minimum daily capacity of 40,000 bbl. Turiamo, situated on Turiamo Bay, about 20 km. east of Puerto Cabello by water and 64 km. northwest of Maracay by road, has been selected as the site for the $50,000,000 project.

The refinery will produce a variety of products, including aviation gasoline, motor gasoline, kerosene, industrial, automotive and marine diesel fuels, lubricating oils of all types, greases, industrial and marine bunker fuels, and asphalts.

In addition to its refinery at San Lorenzo on Lake Maracaibo, which is currently processing about 38,000 bbl. of oil daily, the Shell Group began preliminary work in 1945 for a new refinery near Punta Cardon in the southwest part of the Paraguana Peninsula on the northern coast of Venezuela. The plant will have daily capacity in excess of 40,000 bbl. and will double Shell's refining operations in Venezuela. The refinery will be owned and operated by the Shell Co. of Venezuela, Ltd., a new corporation recently registered in Venezuela.

After considerable study of the entire western Venezuelan coastline it was decided to locate the Shell refinery at Cardon due to its accessibility to Maracaibo where the Shell Group has the majority of its petroleum reserves, and also on account of its location on deep water. Consideration was given to the laying of a pipe line from fields in Maracaibo Lake, but due to the different types of crude produced on either side of the lake, it was decided that more flexibility would be obtained by using tankers.

It is estimated that the cost of the refinery will be in excess of $45,000,000.

Compania Consolidada de Petroleo also made plans in 1945 for the construction of a 35,000-bbl. refinery.

Pipe-Line Expansion Program Continues

IN expectation of an increase in demand for oil from eastern Venezuela, Creole began construction, early in 1944, of a 16-in. pipe line from the Jusepin-Mulata area to Puerto La Cruz on the northern coast of Venezuela. This line was placed in operation in February 1945, and after installation of full pumping equipment has a capacity of 97,000 bbl. of crude a day. The 111.4-mile line is currently running from 38,000 to 65,000 bbl. per day. Mene Grande has a one-third interest in the line.

A new 8-in. and 10-in. line was also laid during the year from Mulata to Travieso for the purpose of segregating Mulata and Jusepin crude.

A 16-in. loop on the Oficina line, 22.8 miles long, will be completed by start of the new year, to provide greater capacity from the Anaco area.

Capacity of Consolidada's 110-mile line from Santa Barbara to Puerto La Cruz was increased to 75,000 bbl. daily by addition of two new pump stations and replacement of old equipment.

Creole will complete installation of new ship bunkering facilities at Las Cocas, outside of Puerto La Cruz. Two 80,000-bbl. tanks are now being installed. A line will be extended to the Mene Grande terminal and bunkers can also be supplied there. Construction of a new and larger pier has been planned. Greatly increased movements of crude oil through this port will provide a substantial market there for marine fuel and diesel oil.

Large Exploration Campaign Under Way in Canada

by Charles J. Deegan

FUTURE prospects for expanded oil development in Canada are much brighter than the declining yearly production figures would indicate. This is indicated by the exploratory campaign now under way and gaining momentum. The names of the companies now actively engaged in exploratory work, especially in the Rocky Mountain foothills of Alberta and in the great plains area to the east, give ample evidence that their geologists consider this a promising territory in which to rebuild wartime-depleted reserves.

Among the more active operators, carrying on either directly or through subsidiaries, are Anglo-Canadian Oil Co.; British American Oil Co.; Gulf Oil Corp.; Home Oil Co.; Phillips Petroleum Co.; Pure Oil Co., Shell Oil Co., Inc.; Socony-Vacuum Oil Co.; Standard Oil Co. of New Jersey; Standard Oil Co. of California; Sun Oil Co.; Superior Oil Co. of California, and The Texas Co.

Through its Canadian affiliate, Imperial Oil, Ltd., Standard Oil Co. (New Jersey) is known to have two seismograph and four surface geological parties in the field in Alberta, and has four wildcat drilling rigs active. In southern Saskatchewan, Imperial has one double-shift seismograph party (equivalent to two normal parties), two surface geology parties, four core drills, and two wildcat drilling rigs. In addition the company has had one seismograph, one gravimeter, and three surface-geology parties active this summer in the Norman Wells region in the Northwest Territories.

Standard of California has two seismograph, two gravimeter, and two surface geological parties active, and operates one stratigraphic test drilling unit. Shell has two seismograph, one gravimeter, and two surface geological parties at work. The Texas Co. is known to have one seismograph and one surface geological party working. Socony-Vacuum is credited with three surface geological parties, and the records indicate Gulf has a seismograph, a gravimeter, and a surface geological party active. Sun Oil Co. has at least one seismograph party active, Phillips Petroleum has two surface geological parties and Superior has at least one.

One indication of the interest in the Alberta foothills belt was the cooperative aerial photographic survey, jointly financed by six of the major groups interested in this region, Gulf, Shell, Socony-Vacuum, Standard of New Jersey, Superior, and The Texas Co. Part of the foothills region had been previously photographed from the air by the Dominion Geological Survey. The joint project covered all the portions not included in the survey work, some 15,000 sq. mi., at a reported cost of about $80,000. Aerial maps afford a good base for reconnaissance and make possible a substantial saving in both time and expense, when more detailed geological work is intended as a follow-up.

Procedure for Obtaining Rights

Companies intending to carry on exploratory work in Alberta first make applications to the provincial Government for a reservation of the oil and gas rights covering the acreage to be investigated. Later, if the company desires to drill, that part of the original reservation that it desires to keep is leased.

The records of the Alberta department of lands and mines indicate that a record 4,000,000 acres was put under reservation during the year ending March 31, 1942. As a result of the United States' entry into the war, it dropped to 1,100,000 acres the next year, climbed to 3,800,000 acres in the following year, and was 3,300,000 acres in the year ending March 31, 1945. Lands put under exploration lease during this period, however, continued to climb steadily. In the year ending March 31, 1945, this hit a record high of 1,096,512 acres, or nearly five times the amount of acreage leased for drilling in the preceding year.

The bulk of the actual drilling activity is in Alberta, partly in the foothills and partly in the plains area to the east. Southern Alberta has between 50 and 60 of the approximately 80 drilling rigs in operation in the entire Dominion of Canada.

Opinion about where the best future prospects lie, whether in the foothills or out in the plains region, is a subject of some debate among geologists. The famous Turner Valley field was found in the foothills, and it has dominated Canada's oil production for so many years that hopes of finding another field of this type rebound from successive disappointments each time a new foothills structure looks promising.

At this time all eyes are centered on the third test of the structure called Jumping Pound, about 25 miles north and west of the north end of the Turner Valley field. Last December a wildcat drilled by the Shell Oil Co. of Canada found gas and condensate at about 9,618 ft. in the Madison lime on top of the structure. Since Turner Valley also produced gas and condensate on top and oil on the west flank, Shell's second test was deliberately started low, to test the flank. This second test, located ⅝ mile southwest of the discovery, topped the lime at 10,639 ft., 1,018 ft. lower structurally than the discovery. Subsequent tests of the well recovered only gas-cut mud and salt water, and drilling was suspended in November. The results of the well indicate that the structure is very steeply folded and engineers are undecided as to what may be expected from future testing. Jumping Pound has not been eliminated from the list of prospective oil and gas fields, however, and a new venture will be drilled about ⅝ mile southwest of the discovery and about the same distance northeast of the failure. Preliminary work on the site is now under way and spudding is expected early in January.

Meantime the plains area is also coming in for more attention, with two new fields opened within the past year. California Standard, a subsidiary of the Standard Oil Co. of California, opened a field named Conrad last July, in which about eight producers have since been drilled. Although comparatively small, the field will probably be a nice profit maker. In September, last year, Standard followed up with another plains field named Princess, in which several producers have since been completed. This field also has the earmarks of being a nice profit maker of small to medium size. There are currently three wells drilling in Conrad and six in Princess.

Most recent discovery in the Central Alberta Plains region is the Imperial-Kinsella Viking sand gas discovery east of the Viking and Kinsella gas fields. These two fields, supplying the Edmonton gas system, constitute the largest gas reserve so far found on the Alberta plains with minimum reserves estimated at 250 billion cubic feet and some estimates as high as 600 billion cubic feet.

Another Imperial-Kinsella test, 6 miles north of the first, indicates a second gas strike, but no official statement has yet been made on the gas potentialities of this well. Both of these recent strikes are being completed at a total depth of about 2,100 ft. and are the first of several deep-structure tests planned

by Imperial for the previously untouched townships of this area. A third test will be drilled 5 miles north and 1 mile east of the first well, and the fourth test will be located 11 miles north and 1 mile east of the same well.

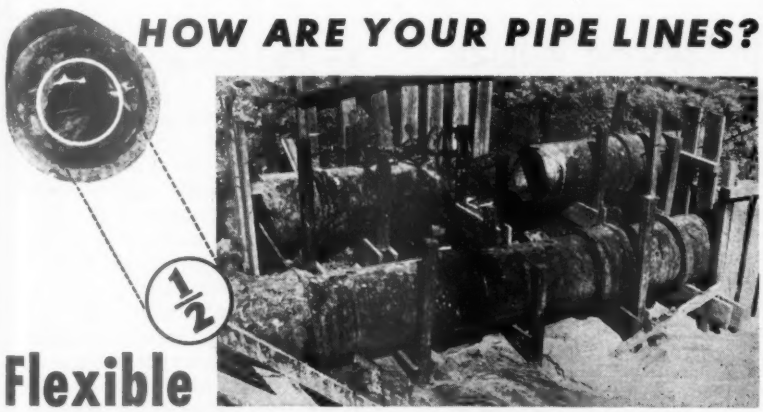
"Organic" Process Operating Instructions

DEVELOPMENT of detailed instructions by organic methods for the operation of complex refining process units is one of the outstanding progress steps which has itself grown out of serious problems of operational training in running these units. One large engineering company—The M. W. Kellogg Co.—works out a "pattern of operation" during the design and construction of a large unit such as a fluid catalytic-cracking plant, each division and step in this process receiving attention in turn. As the unit progresses toward completion and operation these units of instruction are improved, clarified, revised, and perfected until at the time the unit is put on stream the assembly of instruction "chapters" has become a polished operating manual for the information and guidance of the personnel.

It appears that by developing, piece by piece, these instructions as the unit is designed and built, the resulting data in the form of an assembled manual are based entirely on the peculiarities and specific operational dimensions of the individual unit, determined in the light of that individual plant. The manuals include discussion and directions on such subjects as: (1) The process; (2) preliminary operations; (3) starting procedure; (4) normal operation; (5) normal shutdown; (6) emergency shutdown; (7) auxiliary equipment; (8) summary sheets and drawings; (9) operating calculations and inspections.

Government Reports on Shell Refinery Plans

In his annual report to the Colombian Congress, the minister of oil said that the Government had reserved a tract of 4,770 acres near Santa Marta, on the Caribbean coast, for an export terminal and the projected 70,000-bbl. refinery to be built by Shell Oil Co. The permit for the refinery, in the form of a contract with Shell, is being studied in detail. When, and if, signed it will be submitted to Congress for approval.



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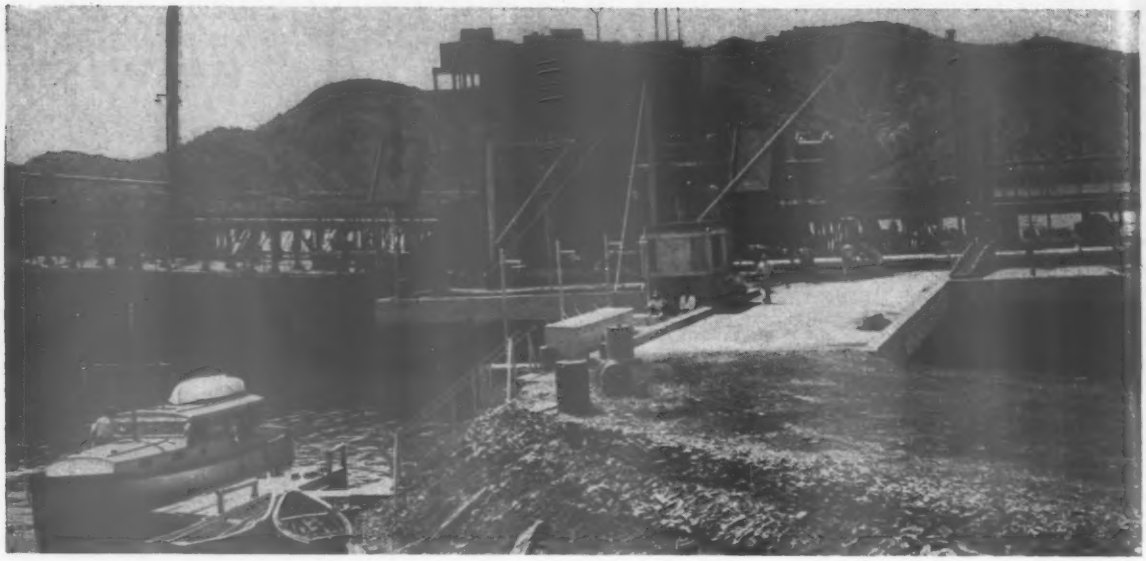


View of boat landing at Puerto de la Cruz, Venezuela

Modern Pressure-Maintenance Plants Being Built in Eastern Venezuela

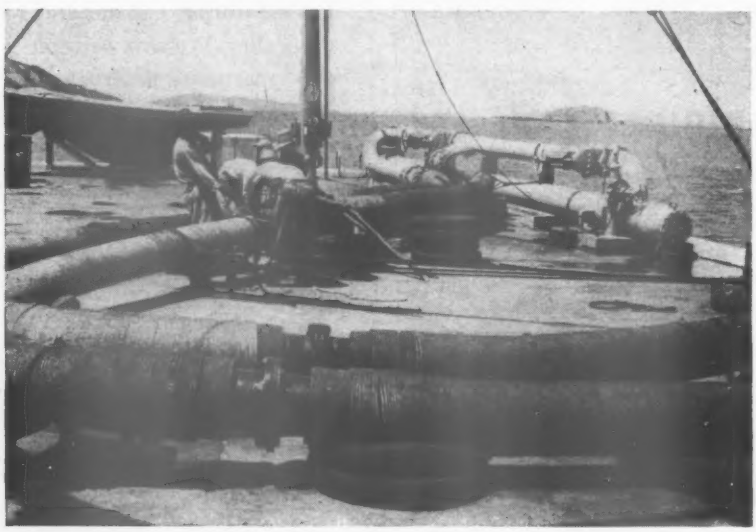
Projects Are Designed to Conserve Natural Resources and Effect Maximum Recovery

by Fabian R. Staley

Experience has demonstrated that the feasibility of applying gas-injection methods of oil recovery to a reservoir depends upon definite inherent characteristics of the rock and also upon the nature of the structure. The important factors are permeability and porosity, continuity of sand within the reservoir, structure relief, suitable trap or seal to prevent escape of returned gas, and absence of major active water drive. Since a combination of all of these requirements is not a common occurrence successful pressure-maintenance operation must be limited in application.

FOUR modern pressure-maintenance plants will be built as soon as possible in eastern Venezuelan fields. Their designs are based upon the latest engineering practice, and they will incorporate the most modern equipment and instrumentation. Creole Petroleum Corp. will build a plant in the Jusepin field, State of Monagas, and construction has started on a plant in the Santa Barbara field, State of Monagas, by Compania Consolidada de Petroleo. Mene Grande Oil Co., C.A., will build two plants in the State of Anzoategui, one in the West Guara field, and a smaller one in the Oficina field proper.

Loading hose on the dock at Puerto de la Cruz



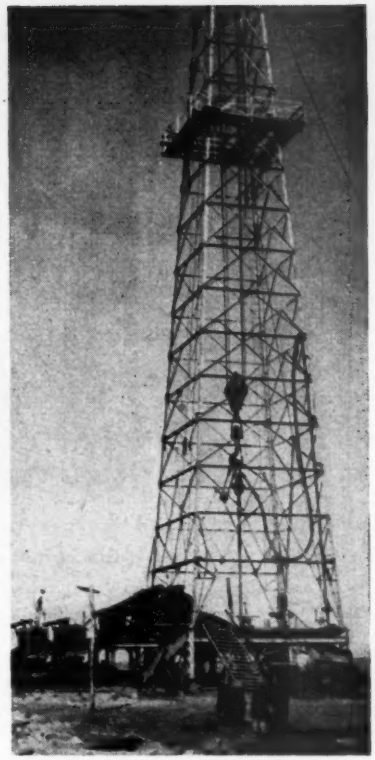
Jusepin Field Project

The Jusepin field was discovered in 1939, and by January 1945, 203

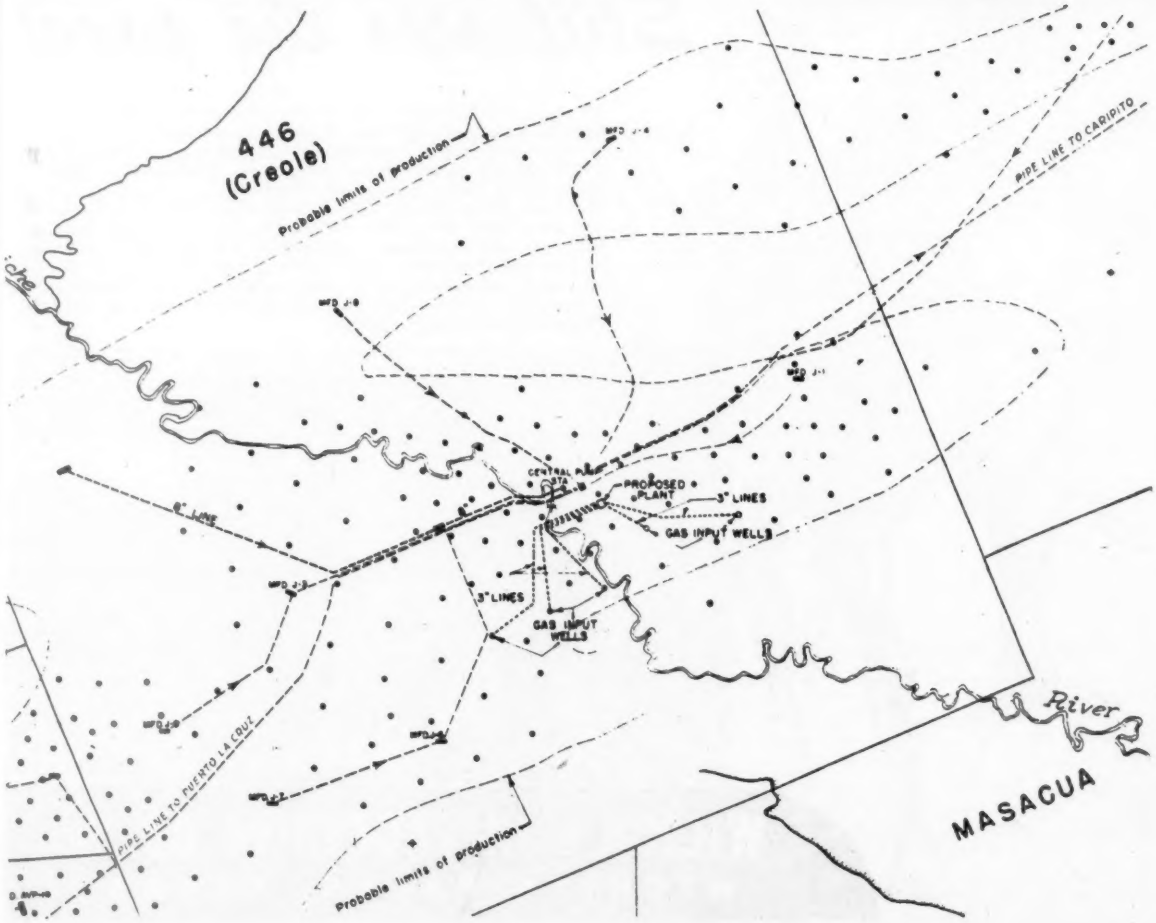
wells had been completed in this field of which 193 were oil producers. The total potential production is approximately 50,000 bbl. daily at an average gas-oil ratio of 1,150 cu. ft. per barrel. The plot plan, Fig. 1, indicates the areal extent of Jusepin field, the approximate limits of production, and the location of wells as of September 1944. New drilling since that time (some 37 wells) has been within the productive limits shown, mainly in the northeast extension and in the southwestern section of the block marked "446—Creole." The sands are reasonably continuous, with good porosity, ranging from 20 to 30 per cent, but low permeability, of the order of 100 md. The field has excellent structural relief. The existence of known barriers, either sedimentary or structural, precludes the possibility of any major water drive. Also some degree of gas segregation has already been noted as high gas-oil ratios are now prevalent among the structurally high wells.

Under this condition, pressure maintenance is expected to increase recovery from approximately 25 per cent of the oil in place to 35 per cent or more, which might correspond to an increase in ultimate recovery of 40 per cent from such areas as are repressured. The new project is intended to return the full gas output of the plant, about 10 million cubic feet per day, to the main Jusepin sand. The new pressure-maintenance facilities will include 1,600 hp. of compressors together with lines and fittings for injecting gas into five existing wells as shown in Fig. 1. The injection pressure should not exceed 2,200 psi.

The new plant will be a combination crude-stabilization unit and pressure-maintenance installation. Crude-desalting facilities will be provided. Crude, delivered to tankers from that portion of the field served by the new project, will be increased from about 40,300 bbl. per day of 32° A.P.I., 6-lb. R.v.p., to about 41,700 bbl. per day of 33.6° A.P.I., 9-lb. R.v.p. This increase of aproximately 1,400 bbl. per day, which results from the retention through stabilization of light ends formerly lost, is essentially butane



Right: Rigging up (mechanical rig) on a well in Santa Barbara field. Below: Fig. 1—The new pressure-maintenance facilities will include 1,600 hp. of compressors together with lines and fittings for injecting gas into five existing wells



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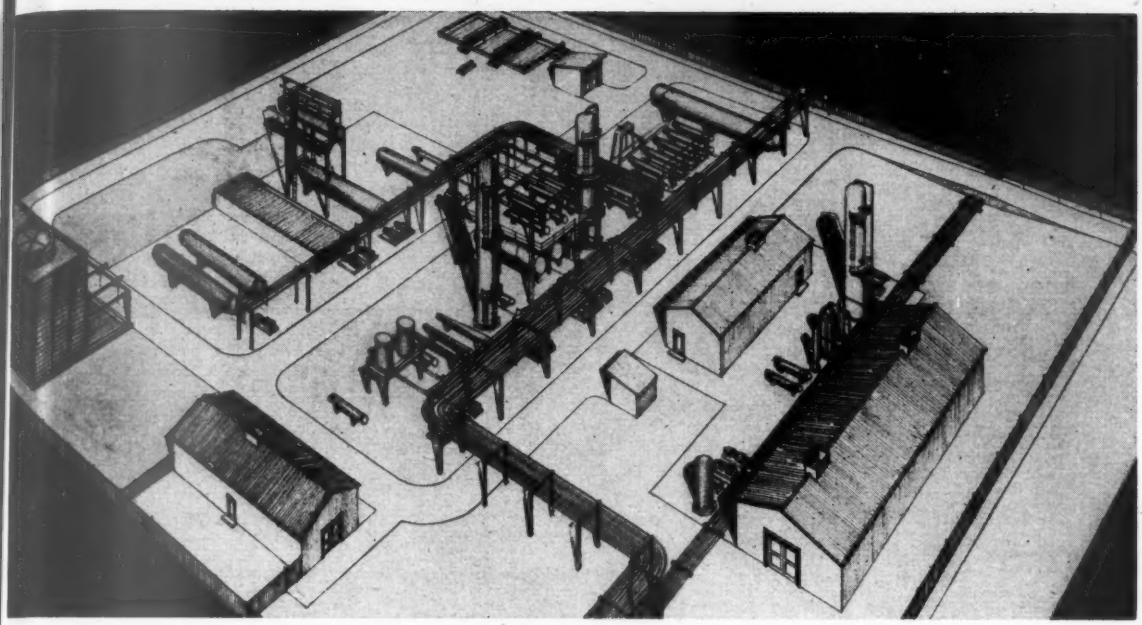


Sketch of crude-stabilization unit, which is combined with the pressure-maintenance installation

and heavier fractions in the gasoline boiling range.

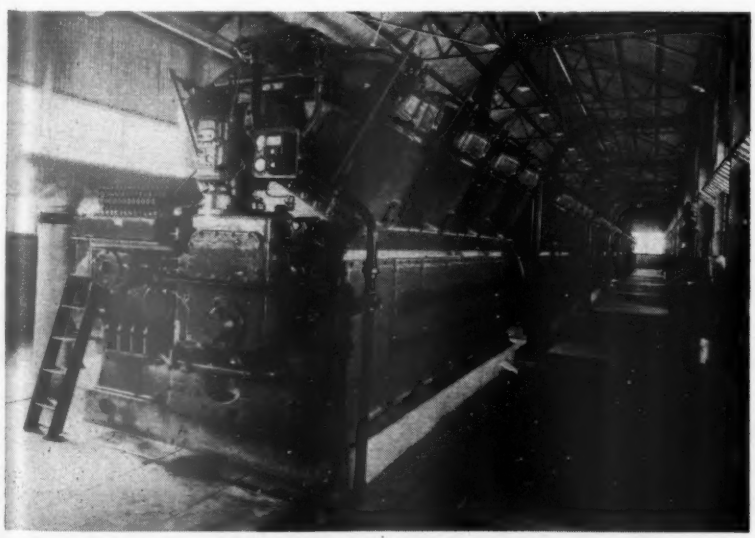
Jusepin crude has been recently run in Creole's Caripito refinery and in refineries in the United States, Canada, and Trinidad. In all these refineries it was processed for Navy diesel fuel, gasoline, and other fuel oils.

Under the proposed system, wells will be produced through new separators at 250 psig. at each of the 11 existing field flow manifolds. Weak wells will be produced at 100 psig. through existing separators and the oil injected into the 250-psig. separator outlet line by means of new blowcases (vacuum-type traps). The 250-psig. separators discharge through existing lines to a new central feed manifold in the proposed plant area. Within the plant the crude is flashed at 100 psig. and stripped of its light ends by means of heat and steam; the denuded crude is pumped to the desalting section.

The light ends are fractionated for the elimination of propane and lighter components, and are then blended back into the denuded crude, after it has been desalted together with additional fractions recovered from the pressure-maintenance plant. The crude stabilization process recovers about 1,400 bbl. per day of gasoline fractions which would normally be lost but does not increase the vapor pressure of the resultant crude to more than 9 lb. R.v.p.

The new facilities will include equipment for desalting Jusepin crude from 60-100 lb. per 1,000 bbl. at present, to 15-20 lb. per 1,000 bbl. without the loss of light ends, by means of hot water washing and settling under pressure. This reduction in salt content will practically eliminate offstream time for the removal of deposited salt in refining units processing this crude, and replacement of equipment damaged by chloride corrosion. The desalting operation is carried out by mixing the denuded crude from the stabilization unit with 50 per cent by volume of recycled brine (to which 3 per cent by volume on crude of fresh deaerated makeup water is continuously added), passing the emulsion through sand-bed coalescers, and into settling drums for brine separation. The operation is carried out at 300° F., and 125 psig. Thereafter, the desalted crude flows through exchangers and coolers to storage, after being blended with gasoline fractions from the crude-stabilization section.

A sump and a pump are provided to permit backwashing the sand-bed coalescers for salt removal. Plant storage will consist of five existing tanks, plus new 55,000-bbl. floating-roof tank which is necessary to permit crude segregation. New equipment will be provided to supply water, steam, power, air, condensate, and fuel connections to and from the plant; fire-fighting facilities; and a



Crack-door side view from end opposite flywheel of Cooper-Bessemer compressor units. They are rated 800 hp. at 300 r.p.m. This type unit will be installed in West Guata field

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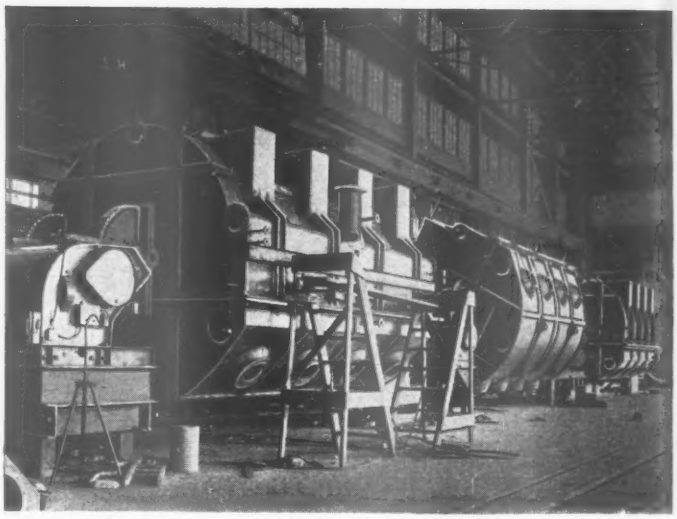

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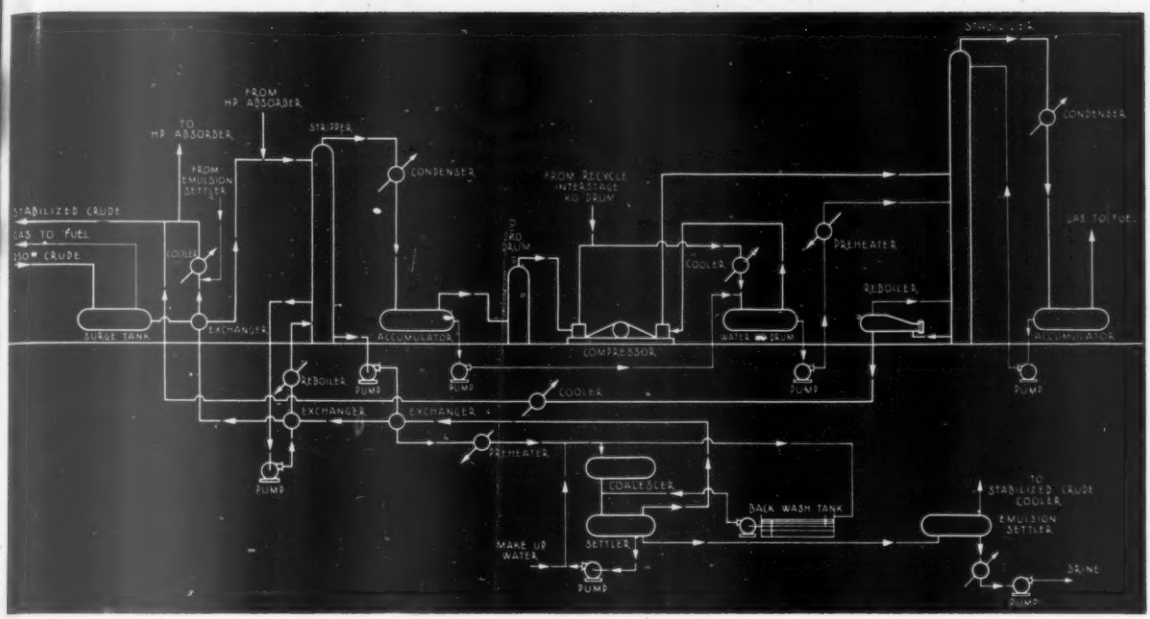


Flow diagram of crude-stabilization unit

75,000-bbl.-per-hour boiler and its auxiliaries will be located in an existing steam-power plant which is located directly across the road from the proposed crude-stabilization plant.

The contract for the design and construction of the combination plant was awarded to C. F. Braun & Co. The plant-buildings are designed to satisfy certain requirements that Creole considers basic. The operators must be comfortable in all seasons. The housed machinery and the instruments must be protected from the weather and from airborne dust. The buildings must be economical to build and to maintain. Building appearance must be pleasing to the eye.

Separate buildings are provided for (1) control house, (2) switch house, (3) compressors. These buildings have structural-steel rigid frames with roofs of galvanized iron. The walls are hollow-tile. The exterior finish is white stucco.

All buildings have forced ventilation with filtered air. Drinking water is electrically refrigerated. The control house includes, in addition to the control room proper, a laboratory, a change room and toilet, and two offices. A steam cooker and coffee maker are provided.

Cumarebo and Quiriquire Fields

Creole Petroleum Corp. has always applied methods of conservation for the production of crude oil. In the Cumarebo field, which started commercial production in 1931, repressuring was started by returning gas to the reservoir in 1933. This project has been an outstanding success in maintaining reservoir pressure. The structure is an anticline cut in two by a major fault. Gas is returned to the SW Socorro-4 sand, which is continuous, having good porosity, high permeability, and excellent structure relief. The repressuring plant returns from 2.0 to 2.5 million cubic feet of gas per day to the sand at an injection pressure of 550 to 600 psi. Up to January 1945 the accumulated production of the reservoir is approximately 17.5 million barrels. Decline from the initial reservoir pressure is estimated at 90 psi., or a drop of about 5 psi. per million barrels of production, as a result of repressuring.

A secondary reservoir in the northeast segment of this field has produced over 4.5 million barrels, to January 1945, and shows a decline of 51 psi. from the initial pressure, or a drop of 12 psi. per million barrels produced. This did not receive the same proportion of gas as did the main reservoir in the southwest segment of the field. Gas returned to both reservoirs in the Cumarebo field was over 7.5 billion cubic feet to January 1945. This field produces about 5,000 bbl. of 48° gravity A.P.I. crude per day. Since 1933 about 400 bbl. of condensate has been returned to the sand daily with the gas. A stabilizer unit is being installed for treating this condensate, and it will then be blended with the crude for export. As a result the gravity of the crude will be raised about 2° A.P.I. The new equipment will include a stabilizer tower, pumps, heat exchangers, and a steam boiler.

Repressuring operation was started by Creole in the Quiriquire field during 1933, and as a result the rate of pressure decline has been retarded. Up to January 1945 this field has produced over 225 million barrels of crude, and over 19 billion cubic feet of gas has been returned to the sands at an injection pressure of about 700 psi.

Santa Barbara Field

A pressure-maintenance and absorption plant is being erected by Compania Consolidada de Petroleo to serve the Muri and Santa Barbara fields. Gas produced from these fields will be processed, and the dry gas will be returned to the producing formations. Crude oil will be stabilized, and some motor fuel will be topped from the crude. Electric power will be generated at the plant. Natural gas produced with the crude will be piped from field separators to the plant at 50 psi. where it will enter scrubbers for the removal of liquid entrainment and foreign material. It will then be compressed in three stages to 200, 750, and 2,200-2,500 psi. and returned at this pressure to the formation through selected input wells. Seven 600-hp. Cooper-Bessemer gas-engine compressor units, having a total daily capacity in excess of 18 million cubic feet, are being installed.

After the first stage of compression, the gas will be cooled and run through an absorption tower in which recoverable hydrocarbons will be extracted. After the second stage of compression, the gas will be cooled in a high-pressure dehydrator for the removal of all traces of humidity before the third compression stage. The absorption plant portion of the project will have a

capacity of 25 million cubic feet of gas per day.

The crude-oil stabilization unit will have a capacity of 60,000 bbl. per day. Vapors recovered will be mixed with the natural gas entering the absorption plant. Oil from the absorber will pass through heat exchangers to a flash tower. Condensate from the flash tower and from the vertical still will be stabilized. Vapors not condensed will be passed through a reabsorber tower. The plant will be equipped to separate propanes and butanes.

A small-capacity topping unit with fractionating towers and heat exchangers will be installed for producing absorption oil and motor fuel. A crude-oil treating unit consisting of two separator tanks for the removal of gas and sediment, a tank for settling out water, and two final settling tanks will handle about 10,000 bbl. of crude daily.

Treated water produced from nearby wells will supply the plant, and four 150-hp. boilers will generate the steam required. Electric current for the project will be generated by three 600-hp. gas-engine generators. Careful attention has been given in designing the buildings to the workmen's well-being, safety, and health. At strategic points throughout the plant, control switches will be installed by which all plant operations can be stopped in case of emergency. Other units to be erected include office building, laboratory, warehouse, garage, locker rooms, showers, sanitary installations, alarms, and fire-fighting equipment.

Dimensions of some of the larger vessels and towers being installed in the plant are:

	Internal diam. (in.)	Length (ft.)
Absorber	84	74
Reabsorber	36 and 54	69
Flash tower	60	76
Still	60	80
Depropanizer	48	89.5
Deethanizer (L.G.G.)	36	89.5
Topping still	42	52
Reclaimer	42	40
Dehydrators (2)	48	24

An analysis of Santa Barbara gas is:

	Per cent
Methane	78.71
Ethane	9.49
Propane	6.10
Isobutane	1.41
n-Butane	2.18
Isopentane	0.83
n-Pentane	0.47
Hexane and heavier	0.81
	100.00

West Guara Field

Bechtel-McCone Corp. is designing two pressure-maintenance and recycling plants for Mene Grande Oil Co. These plants are expected to be in operation by July 1946. The major plant will be built in the West Guara field. The plant will handle about 34 million cubic feet of gas daily which will be returned to the producing formations at approximately 1,800 psi. input pressure. Six 800-hp. GMV Cooper-Bessemer compressor units, and two 800-hp. gas-engine generator units will be installed. The compressors are three-stage units, and suction at the duplex headers will be 50 and 150 psi. A single absorber will scrub the gas, and about 400 bbl. of natural gasoline recovered from the gas daily will be stabilized and blended with the crude oil.

Gas will be collected from four central gathering stations, and the gas that is now being vented from the separators will be utilized for pressure maintenance. Compressed gas will be returned to the producing formations through seven input wells located near the high point of the structure adjacent to the fault. Their selection will depend upon the extent of the gas cap when operations start. Most of the wells in this field are dual or triple-zone completions.

In each of the input wells one of four sands possessing satisfactory physical characteristics will be injected with the compressed gas. The lower sand or sands, in the case of triple-zone completions, will continue as productive zones. The sands selected for pressure-maintenance are as follows:

Sand—	Approx. depth (in. feet)	Original shut-in pressure (lb.)
D_3	5,350	2,035
D_4	5,450	2,115
F_1	6,000	2,300
H	6,200	2,350

The discovery well of the West Guara field was completed in June 1942 as a dual-zone producer at a total depth of 8,096 ft. Initial production from the upper and lower producing horizons was 1,260 bbl. per day. The upper sand, I_3, produced 550 bbl. per day of 37.6° A.P.I. gravity crude, with a gas-oil ratio of 370 cu. ft. per barrel. The lower producing sand, M_3, gaged 705 bbl. per day of 21.8° A.P.I. crude with a gas-oil ratio of 300. After a workover the I_3 sand was squeezed off and the casing closed in on account of the high gas-oil ratio. Currently the well is producing about 590 bbl. per day through the tubing from the M_3 sand with a gas-oil ratio of 530.

Basic geology of the field is a simple, faulted monocline with strike of the fault trending in general east-west direction. Regional dip is to the north toward the center of the Maturin basin. The main fault trace is uncomplicated by branch faults and is upthrown on the north or basinward side. Closure against the north side of the fault controls accumulation. Producing formations are Mio-Oligocene in age. There are 29 productive sands in the field, designated by letters from "A" to the lowest sand "U," and the nonproductive Temblador formation, underlies the "U" sand.

The field covers 3,136 surface acres of concessionary land. Eighty-four wells have been drilled to date, and 83 have been producers. The field produces about 50,000 bbl. of crude daily, of approximately 40° A.P.I. gravity. Initial gas-oil ratio was 700 cu. ft. per barrel.

Oficina Field

Mene Grande Oil Co.'s pressure-maintenance plant in the Oficina field will have an 800-hp. Cooper-Bessemer single-stage unit which will handle 12 million cubic feet of gas per day. Natural gas from a dry-sand reservoir at an intake pressure of 500 psi. will be compressed to 1,400 psi. and injected into the "L" sand which is the largest single reservoir in the field. The daily crude production from this sand is 10,000 bbl. with a gas-oil ratio of 500 cu. ft. per barrel.

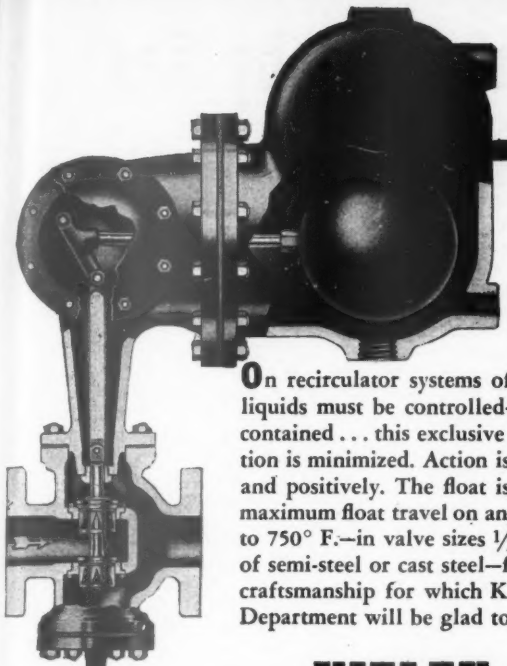
The gas will be collected from one or two wells located near the three wells that will be used for gas input. These input wells are situated near the southern end of the field, and are now closed because of their high gas-oil ratio due to gas cap expansion.

This field covers 12,000 surface acres of concessionary land. The discovery well was completed May 1937 as a producer from the Oficina formation of Miocene age. Initial production was 1,327 bbl. per day of 28.5° A.P.I. gravity crude from the "L" and "S" sands. The initial gas-oil ratio was 500 cu. ft. per barrel.

The basic structure of the field is a faulted monocline, and the stratigraphy is similar to that of the West Guara field. There are 26 producing sands in the area. The daily production of the field is about 40,000 bbl. of approximately 30° A.P.I. gravity crude. Experimental work will be carried on in certain segments of the Oficina field to study the feasibility of using water drive.

Mexico Pays Installment on Expropriated Properties

WASHINGTON.—Rafael de la Colina, charge d'affairs for Mexico, has given to Dean Acheson, acting secretary of state, a check for $4,085,327.45 in part payment for American oil properties expropriated in 1938 by Mexico. The State Department said this left $8,170,654.90 to be paid within the next 2 years to liquidate the original debt of $29,137,700.84.



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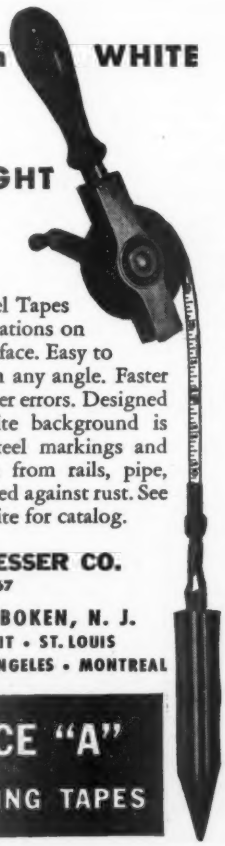

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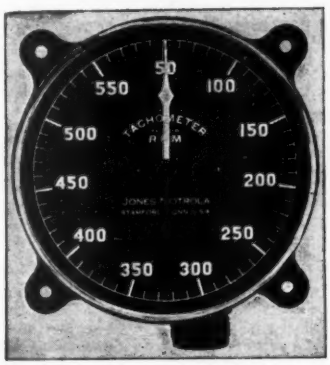

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Water Invasion Controlled by Gas Injection in Bahrein Island Operations

BAHREIN ISLAND, Persian Gulf. The Bahrein Island oil field provides the essentials for studies in reservoir behavior; a thick limestone producing member with generally high horizontal permeability and a fair degree of vertical permeability, oil undersaturated with gas, no natural gas cap under initial conditions, an active water drive, and an adequate supply of high-pressure dry gas from a deeper zone for experiments in gas injection. The Bahrein Petroleum Co. has taken full advantage of these natural assets and it is the purpose of this article to recount the use to which the company has put them in the control of water invasion by gas injection.

Previous articles of October 20 and October 27, 1945, described the geology of the island and drilling and producing practices. Notwithstanding this a brief historic review of the development of the Bahrein Island field will be helpful here by way of introduction.

The first drilling party arrived in Bahrein Island on May 26, 1931, and well No. 1 was spudded on October 17, 1931. Drilling was done with a diesel-electric-powered cable-tool drilling rig and the well completed in what subsequently proved to be the top of the principal limestone member of the Bahrein zone.

The areal extent of the field was fairly well projected after the drilling of the next few wells. A definite development program was then outlined for the field with wells to be drilled to the Bahrein zone on a rhombic grid system giving a lateral triangular drainage pattern on 3,000-ft. spacing with one well per 178.93 acres. All locations on this pattern within the productive limits of the field have been drilled as well as a number of secondary locations on 1,732-ft. spacing with one well to 59.64 acres. Further development of the field on a formal grid pattern has been abandoned and The Bahrein Petroleum Co. now plans to locate future development wells in a downstructure band around the field beyond the gas cap. This point is explained more fully in the last paragraph of the article.

Cable-Tools on Early Wells

The early wells were drilled by cable tools from spudding to completion, but this method was soon superseded by use of combustion rigs in which cable tools were used to drill through the upper lost-circulation zone down to a depth of approximately 1,700 ft. and rotary tools were used for drilling in (see previous article of October 27, 1945). Drilling by this same method was speeded up by use of a portable spudder to drill the lost-circulation section and to cement the Blue shale water shutoff string. A rotary rig followed the spudder and was used for drilling in and completion.

These early wells, the first 40 or so, were drilled before the independent nature of the producing horizons of the Bahrein zone had been fully recognized and completions were characterized by a lack of uniformity in penetration. The casing program for this early group of wells was a primary water shutoff string cemented in the Blue shale at approximately 1,700 ft. and a secondary water shutoff string cemented either just above the highest producing member of the First Pay or just above the main body of Second Pay limestone and with perforated liner landed through the producing section penetrated. The depth of penetration was in general determined by the estimated position of the water table at the location of the well. The latter 35 wells have been completed either as single-zone or dual-zone producers with liner cemented through the entire producing section penetrated and gun perforated opposite the zone or zones to be produced.

The Bahrein structure is an anticline of the simplest form with its major axis lying almost due north and south. Dips within the oil-pro-

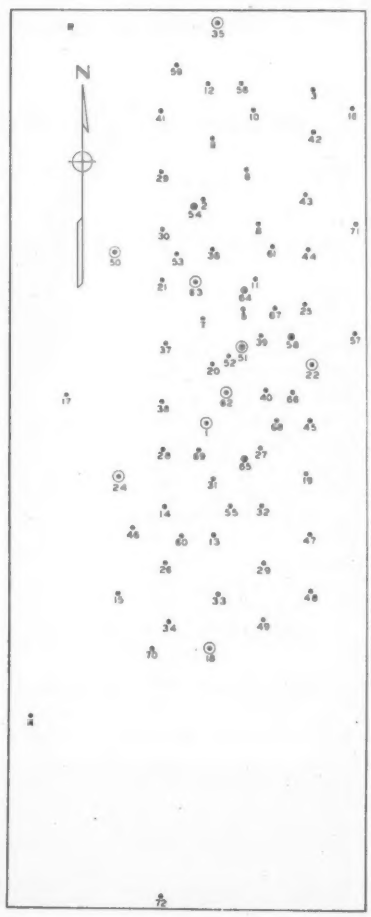
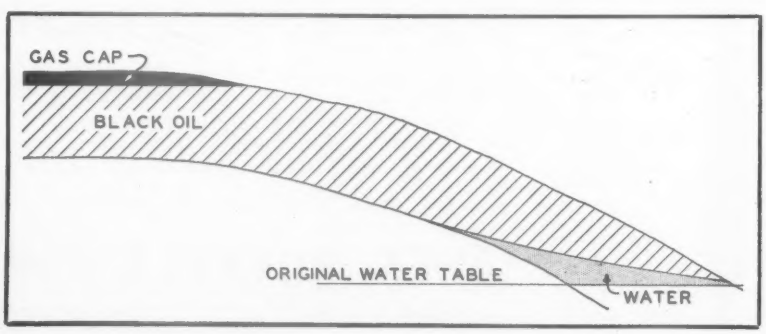


Fig. 1 — (Right) Bahrein Petroleum Co., Bahrein Island. All wells are to Bahrein Zone, except those with double circles, which are completed in deeper zones. No. 1 is a gas-oil contact observation well. Second Pay limestone. Nos. 18, 22, and 35 are oil-water contact observation wells, Second Pay limestone. Nos. 24 and 50 are proposed for oil-water contact observation wells. No. 63 is a gas-injection well, Second Pay limestone. No. 62 is a gas-injection well, First Pay. No. 51 is a gas-supply well

Fig. 2—(Below) Composite cross-section of portion of Second Pay limestone Zone. Vertical dimension exaggerated



ducing limits of the field are low but the dips on the south and west flanks are slightly steeper than those on the north and east flanks. There is no evidence of faulting.

The producing section on Bahrein Island is generally known as the Bahrein zone and is made up of what has been locally designated the First Pay and the Second Pay. These local designations were unfortunate because they were not sufficiently descriptive, and are "hang overs" from early exploratory work. The Bahrein zone is a productive section of about 500 ft. in thickness occurring between the depths of 1,700 and 2,200 ft. on the crest of the structure and comprise four producing zones separated from one another by impervious strata of shale or limestone. From top to bottom they are: First Pay—a series of three limestone members, Second Pay limestone—a single thick stratum of limestone, Second Pay siltstone—a thick stratum of sand, and Second Pay siltstone Zone D — a thick stratum of sands.

First Pay Least Permeable

The First Pay is the least permeable of the producing members and beyond the productive area of the field its permeability drops to a point to make an active water drive impossible. Production from this zone would normally have been under volumetric control but gas injection to the zone on the crest of the structure, commenced in 1938, has maintained pressure in that zone at or about its initial reservoir pressure. The oil in this zone is undersaturated with gas and there was no initial gas cap.

The Second Pay limestone is a uniformly thick body of limestone extending over the entire field and well beyond the productive limits of the field. The permeability of this limestone member is generally high. Strata composing it vary widely in permeability but none are sufficiently tight to interrupt vertical permeability.

The Second Pay siltstone occurs next below the Second Pay limestone with an intervening series of impervious strata. Variations in thickness do not exceed approximately 10 per cent and the zone extends over the entire field and well beyond the productive limits of the field. There is a considerable variation in permeability laterally within the zone and all strata are sufficiently permeable to display vertical permeability throughout.

The Second Pay siltstone Zone D is the lowest producing member of the Bahrein zone. It exhibits vertical and lateral permeability similar to that of the overlying siltstone. This zone is oil bearing only in the central portion of the field with its oil content trapped as a dome against the overlying cap rock by bottom water in the zone.

The bottom water table of the Second Pay siltstone Zone D extends horizontally under the entire field establishing the productive limits of the overlying Second Pay zones at the flank positions where these zones intersect this common water table. The Second Pay limestone and siltstone zones were under an initial reservoir pressure of 1,236 psi. measured at datum plane, 1,900 ft. subsea. There was no initial gas cap in any one of these three zones and the reservoir crude in each is undersaturated with gas with bubble points of the order of 300 psi. The Second Pay limestone is the principal producing member of the Bahrein zone and it is this zone to which this article is devoted.

Below the Bahrein zone is a Third Pay occurring at a depth of approximately 3,700 ft. This pay is not commercially productive.

The Fourth Pay occurring at a depth of approximately 4,200 ft. is the stratigraphic equivalent of the Arab zone, the main producing zone of the Damman, Abqaq, and Qatif structures on the Arabian mainland. The limestone members of this zone in the Bahrein field contain only dry gas or a thin black oil band with a large gas cap area. The formation pressure in this zone is approximately 2,150 lb. Gas produced from a limestone member containing only dry gas is injected to the Bahrein zone without compression.

The following is a tabulation of production from Bahrein Island by years from commencement of operations to date:

Year—	Total prod. (U. S. Bbl.)
1932	902
1933	31,377
1934	285,072
1935	1,264,807
1936	4,644,635
1937	7,762,264
1938	8,297,998
1939	7,588,554
1940	7,073,919
1941	6,794,157
1942	6,240,627
1943	6,571,609
1944	6,713,795
1945	*6,086,444
Cumulative production*	*69,356,160

*To and including October 31.

During the first few years and before completion of the refinery, production of the field was controlled by offshore shipments of crude oil. This caused the field to be produced irregularly from very low rates of production to very high rates and gave an opportunity to observe reservoir behavior pressure interference between wells, and rate of pressure build up in the reservoir following periods of high production.

Reservoir-pressure decline was rapid in the early life of the field but a fully active water drive was established after the production of approximately 10 million barrels of oil. The water drive was found to be sufficiently active to maintain reservoir pressure above the bubble point of the unsaturated crude up to a high rate of withdrawal throughout the life of the field and the energy within the crude itself by virtue of its dissolved gas is not called upon to play any part in the movement of oil within the reservoir or in lifting the oil to the surface. The Bahrein Petroleum Co. recognized early in the life of the field that the rate of withdrawal must be controlled at a rate to maintain a normal gravitational segregation of the oil and water in the reservoir to avoid fingering-in of water and the possibility of isolating and trapping large bodies of oil.

Production from the field was increased as development progressed and reached a peak in 1938 of something over 25,000 bbl. per day. Withdrawal from the individual wells was allotted on a formula based on proximity of the well to edgewater and factors based on reservoir pressure and productivity index of the well to preserve uniform pressure gradients within the reservoir. Notwithstanding this, water invasion was uneven and large irregular inroads of water deep into the field were observed. This production rate did not permit sufficient gravitational segregation of the oil and water.

Gas Injection Started

In April 1938 gas injection was started to the First Pay and the Second Pay limestone. The gas injection rate to the First Pay was selected to bring pressure in that zone to approximately its original reservoir pressure and to maintain it at that level. The gas injection rate to the Second Pay limestone was selected to produce approximately 40 per cent of the oil from the zone by displacement by gas and reduce from 100 per cent to 60 per cent the production of oil by displacement by encroaching edgewater.

In 1941, 41 of the 74 wells were plugged with cement against sabotage and the field withdrawal rate was reduced to 18,000 bbl. per day. In November 1944 the plugged wells were rehabilitated and the production rate was returned to 20,000 bbl. per day. The Second Pay limestone contributes the majority of the total field production. The First Pay contributes a relatively small amount of production and presents no water problem. The Second Pay siltstone had commenced to show water prior to the plugging program of 1941 but the problems it presented were insignificant in comparison to those of the Second Pay limestone. Advance of water in the siltstone section during the years 1941 to 1944 was masked by the reduction in withdrawal points and now, with

the rehabilitation of the secured wells, a study of it is under way.

Physically, gas injection to the First Pay and Second Pay limestone was accomplished by laying a 4-in. line from the christmas tree of a Fourth Pay dry gas producer, through a meter run, and directly into the tubing of the injection wells. Pressure and injection rates are controlled by an adjustable flow bean at the gas supply well. Maintenance of the system has been negligible except that hydrates frequently plug the line in the winter months. In the expanded gas-injection facilities, now in construction, the first stage of pressure reduction from the supply well will be by pressure regulator and the final adjustment by manually set flow valves at a header from which injection lines will radiate to the injection wells. The injection lines will be buried to maintain higher line temperature through the cool winter nights.

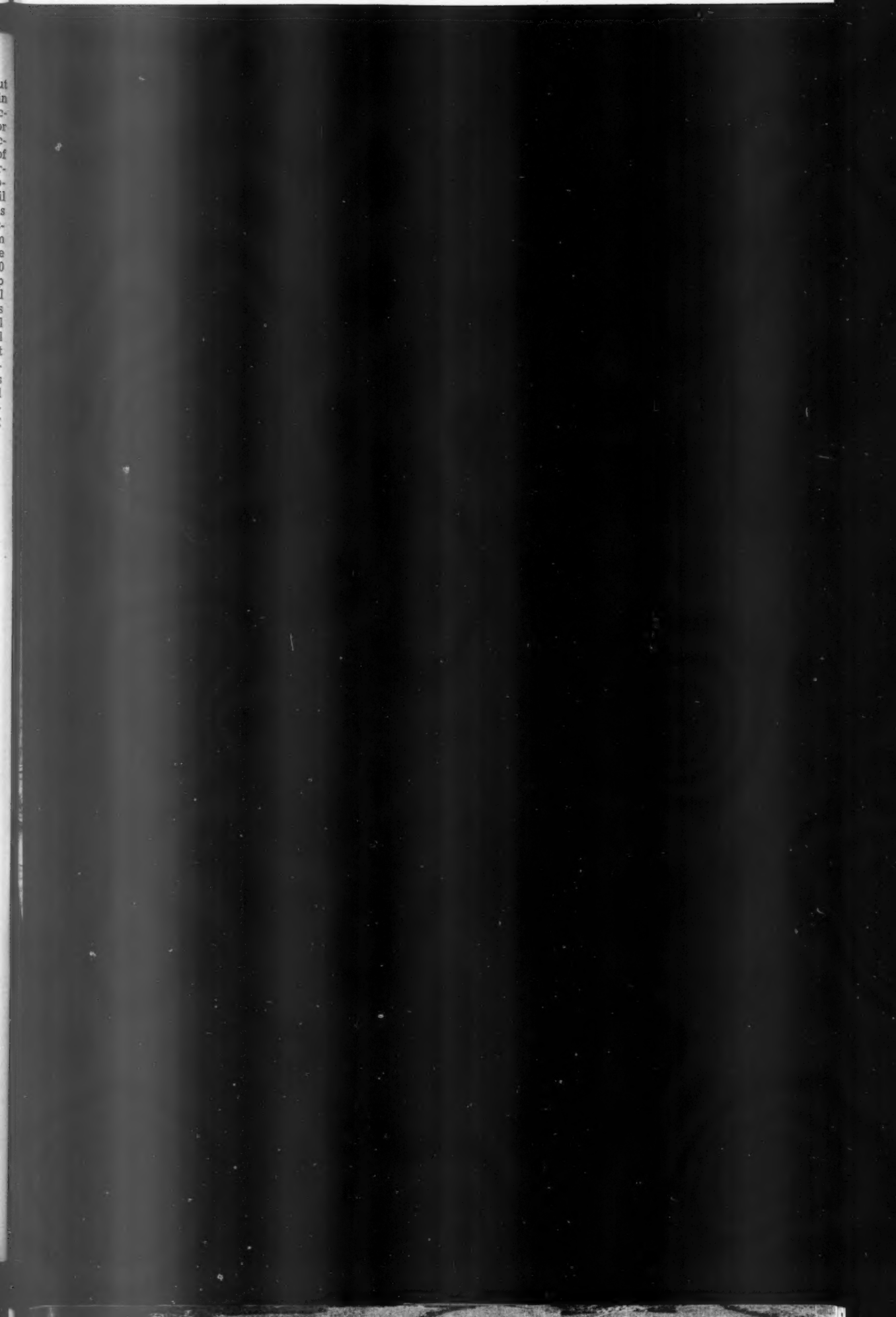
Effect on Second Pay Limestone

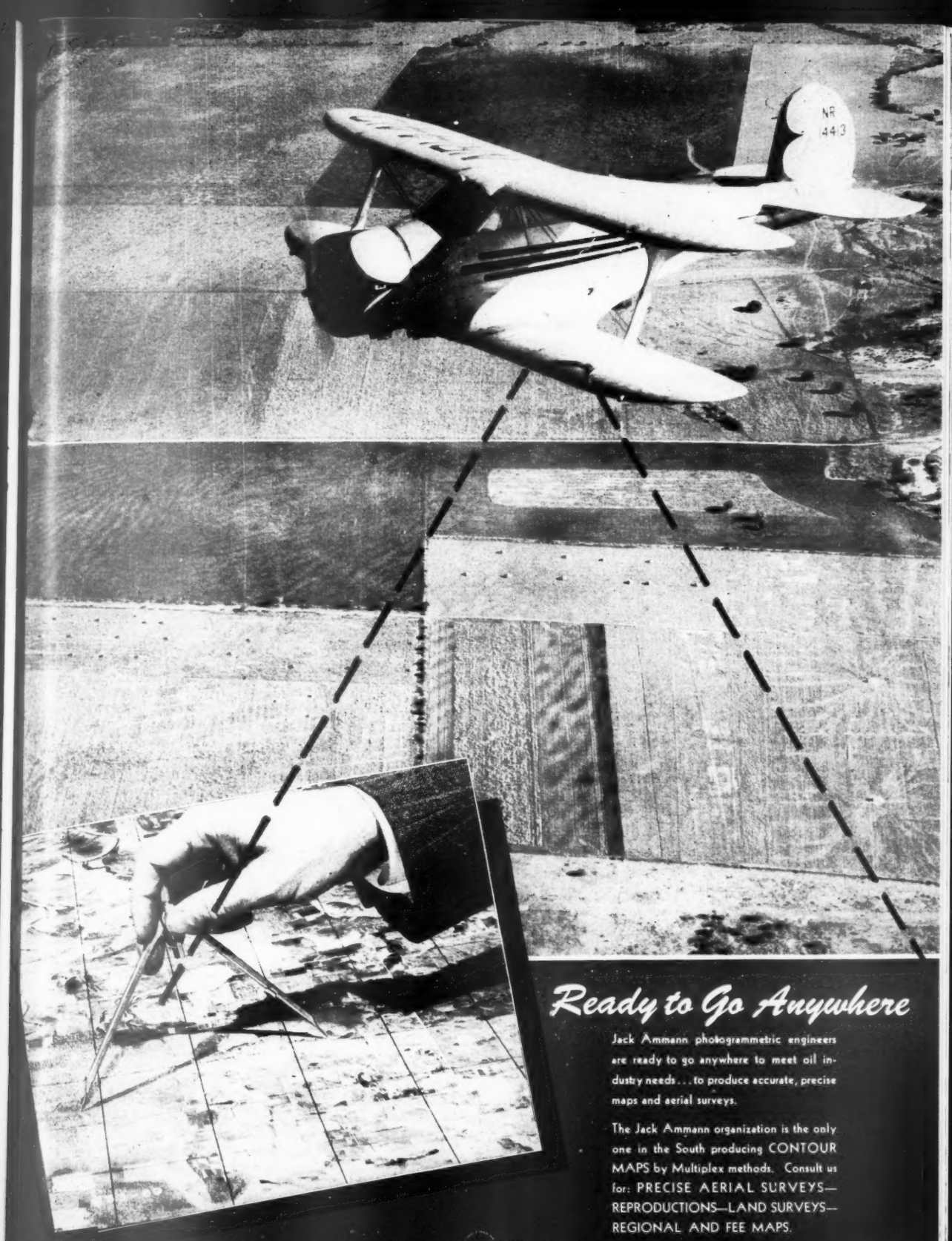
The first observable effect on the Second Pay limestone after start of gas injection in 1938 was a rapid rearrangement of pressure contours followed by a progressive lowering of the pressure gradient on the flanks of the structure. This and a slight recession in the farthest advance of water encroachment as evidenced by lowering in water cut were the only indications Bahrein company engineers had of the success of their gas-injection project for some time. Gas injection to the Second Pay limestone was to one of the wells located highest structurally and gas did not make an appearance in any other well until over 2 years after gas injection was started. The shut-in surface pressures of producing wells are from 425 to 450 psi. and surface pressure drawdown while flowing is 10 to 50 psi. Surface pressures do not drop below the bubble point of the oil and a liquid column of oil stands to the surface at all times. Normal gas-oil ratio is the solution gas-oil ratio only which is quite constant at 125 cu. ft. per bbl. of oil produced. Appearance of extraneous gas in a well is readily recognized by collection of free gas in the casinghead and a sharp rise in casing pressure.

Well No. 1 is located highest structurally of the wells completed in the Second Pay limestone and Bahrein company engineers concluded that if gas-cap expansion followed the text book pattern gas would make its first appearance in well No. 1. Top of perforations in well No. 1 is 13 ft. below the crest of the Second Pay limestone. Formation volume in the Second Pay limestone above a horizontal plane passed through the top of the perforations in well No. 1 was calculated as were also formation volumes above horizontal planes passed through successively lower points. The tubing in well No. 1 was raised above the perforations and accurately measured, and the well closed in to await the appearance of gas. The position of the tubing shoe is used as the reference point in gas-oil contact observations. (See article of October 27 for detail of making these observations.)

Gas Makes Appearance

On August 11, 1940, gas made its appearance at well No. 1. This appearance was recognized by accumulation of gas in the casing and a sharp increase in casing pressure. Thereafter, at approximately 6-month intervals, the oil level in well No. 1 has been recorded. By October 1945 it lowered 12 ft. or to a total of 25 ft. below the elevation of the top of the limestone at the crest of the structure. It is assumed that the gas-oil contact in the reservoir is a horizontal plane and that the oil level in well No. 1 coincides with this plane. That this assumption is approximately correct is borne out by the following: The variation in ratio of volume of gas injected to volume of formation occupied by gas as computed for each gas-oil contact observation has been less than plus or minus 2 per cent. Gas volumes entering into this ratio are metered and formation volumes





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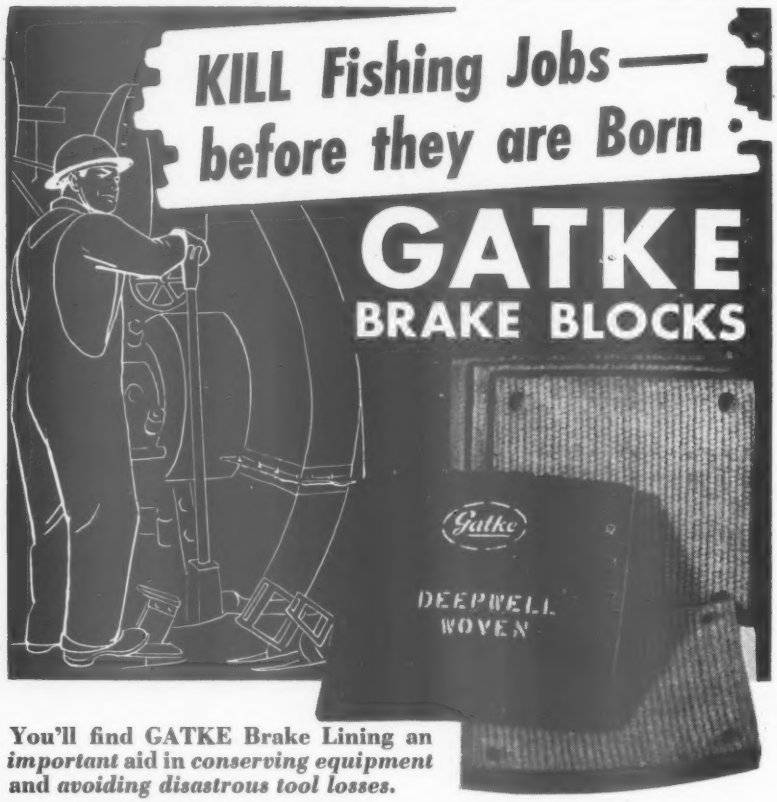
above the assumed horizontal gas-oil contact plane are calculated. This ratio (per cent of formation volume voided by gas) without a factor for volume of gas going to solution in the oil is 25. Further, subsequent to appearance of gas in well No. 1, gas has appeared in four other limestone-zone wells in the order anticipated by their structural position. As gas has appeared in these wells production rates have been reduced to a point to maintain a fluid seal around the tubing, which is placed near bottom.

An examination into the exact manner in which water was invading the field had not progressed far prior to 1941 and the plugging of a great number of the wells in 1941 postponed most of this work during the war years. Now, with the rehabilitation of these wells this work has been resumed and indications are that it will be fruitful. The cross-section (Fig. 2) shows the extent and nature of water invasion as interpreted from producing and drilling records. The cross-section is a composite of a number of cross-sections on which were plotted penetration of wells into the limestone zone and their production data, and drilling and testing data where pertinent. Curves were then drawn through these sections such that any well bottomed above the curves produced clean oil, and any well penetrating below the curve produced some amount of water. It cannot be concluded from this type of data that the entire formation in the shaded area below the curve is water flooded nor can the effectiveness of water flushing be judged.

In April 1945, three flank wells were converted to oil-water contact observation wells (see map, Fig. 1, and description in article of October 27) and the oil-water contacts found in these wells fitted closely with the previously conceived idea of the position of the water-table at these locations. Plans for 1946 are to drill four new oil-water contact observation wells, directly upstructure from each one of the present observation wells to provide two points on the oil-water contact curve in each quadrant of the field. Irrespective of the findings that may result from this work, the present concept of water invasion fits the practical problem of producing the oil.

The Bahrein Petroleum Co. plans for its 1946 program to drill a second gas-injection well to the Second Pay limestone and to commence a gas-injection trial to the next lower zone. Gas injection to the limestone zone will be stepped up to displace 75 per cent of the oil produced from that zone by gas drive and to reduce displacement of oil produced by water drive from the present 60 per cent to 25 per cent.

Replacement wells must be drilled at Bahrein as crestal and edge wells are captured by gas and water. Wells located at that position on the structure upon which the expending gas cap and encroaching edgewater will converge will have the longest useful life. It appears that determination of that position is within the control of the operator. It is too early to project where that position should be but new drilling locations are being staked to approach it as closely as possible.



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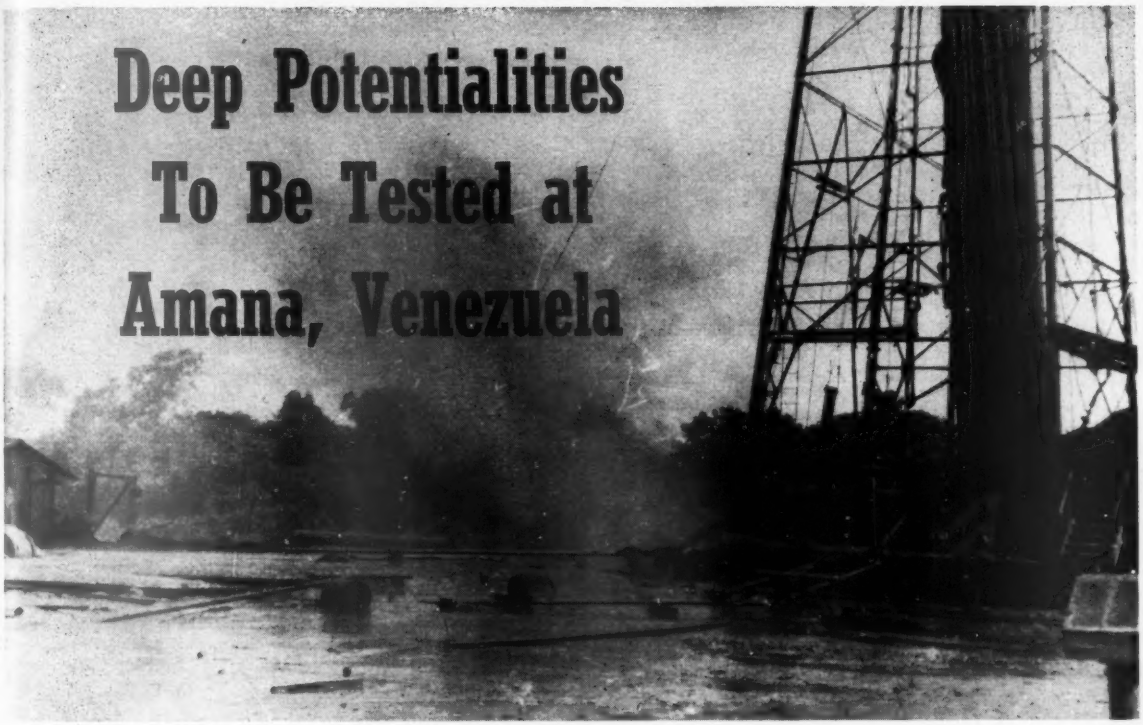
New Continental Tanker On Shakedown Cruise

PONCA CITY, Okla.—The S.S. Lake Charles, new flagship of Continental Oil Co.'s tanker fleet, launched recently at the Bethlehem-Sparrows Point Shipyards, Sparrows Point, Maryland, has been fully commissioned and is now on her shakedown cruise to the Gulf Coast.

The new tanker, one of the first completed since war's end, is named for Lake Charles, La., the city at which Continental's main Gulf Coast refinery and terminal are located. Cost of building was approximately 3 million dollars. It has a cargo capacity of 134,000 bbl. and storage space for 11,650 bbl. for her own fuel oil.

Deep Potentialities To Be Tested at Amana, Venezuela



El Roble No. 1, blowing wild. Discovery well of Creole-Pantepec El Roble field with proven reserves of 131,470,000 bbl. and additional prospective reserves of 393,530,000 bbl., averaging over 50° A.P.I.

PLANS to explore the deeper productive possibilities in the Amana (Mulata) field in 1946 on the jointly operated property of Pantepec Oil Co. of Venezuela and Creole Petroleum Corp. call for assignment of one deep-drilling rig to this work during the last quarter. In the forepart of the year, the joint operators will engage five rigs in development of the regular Amana pay at 4,500 to 6,500 ft.

In 1943 Pantepec made an agreement with Standard Oil Co. of Venezuela (a wholly owner subsidiary of Creole Petroleum Corp.) covering the exploration of over 1,000,000 acres, whereunder Standard drilled 20 wells without cost to Pantepec. Of these, 12 were producing, discovery or development wells in the TR, TRN, Tabasco, and El Roble fields. Socororo No. 1, southwest of Mene Grande's Oficina field was a producer, but this area still remains to be developed. By subsequent drilling for joint account, the Mulata field on Amana concession was discovered and has been developed.

In 1943 the properties subject to the original Standard - Pantepec agreement of 1943 were subdivided, with the exception of the developed producing fields. These fields, covering 35,601 acres of El Roble, 24,563 of Amana, and 13,906 of TR, TRN and Tabasco, are being operated jointly by Creole and Pantepec as unitized properties on an equal participating basis.

In 1939 production started from the TR and TRN fields, developed under the original Standard-Pantepec contract. In May 1940 shipments began from the El Roble field, and in August 1943 from the Amana field. During the first 10 months of 1945 production from these properties averaged 35,216 bbl. per day, as compared with 22,106 bbl. per day in 1944.

Atlantic-Pantepec Agreement

From the subdivision of the acreage under the Creole agreement, Pantepec retained 326,146 acres in eastern Venezuela. In February 1944, Pantepec entered into an agreement with Atlantic Refining Co. for the drilling of that acreage. Atlantic obligated itself to drill at its own expense eight exploratory wells on designated drilling blocks, and to maintain all concessions in force, tax-free to Pantepec, during an option period ending in April 1947. Atlantic has the option of acquiring a 50 per cent interest in these concessions in two separate stages. After the exercise of the option, the areas so acquired are to be operated for joint account of both companies.

Four wells were to be drilled in the State of Monagas on the Pirital block consisting of 21,437 acres. Atlantic had a year's option on a 50 per cent interest in the Pirital block for the sum of $2,000,000. This option was exercised by Atlantic on May 31, 1945. Atlantic has the further option, after the completion of the exploratory wells, to acquire a 50 per cent interest in the remaining 304,709 acres by paying to Pantepec an additional $2,000,000, besides granting a $500,000 credit (without repayment) for development.

Atlantic has completed two of the contract wells and is drilling three others. Avipa No. 1 was a 150-bbl. producer. Morichito No. 1 was abandoned because of mechanical difficulties before the contractual depth of 6,000 ft. was reached. Morichito No. 2 is drilling as a replacement well. Punta Gorda No. 1 was completed and abandoned below 6,000 ft.

Obligatory wells, 1 San Pedro and 1 Hueso to be carried to a minimum depth of 8,000 ft., are now drilling. Tonoro No. 1, not an original contract well, is being drilled on account of favorable indications and to make up for footage requirements.

All of the above wells, completed or drilling, are on blocks located in close proximity to eastern Venezuela's greatest development activity, the Santa Barbara-Mulata-Jusepín fields.

Although but one of the wells so far completed has encountered production, all now drilling or to be drilled, are on well-defined geological features, favorable for trapping oil in commercial quantities.

Present plans are to spud in the remaining obligatory Atlantic wells in Anzoátegui and Guárico early in 1946.

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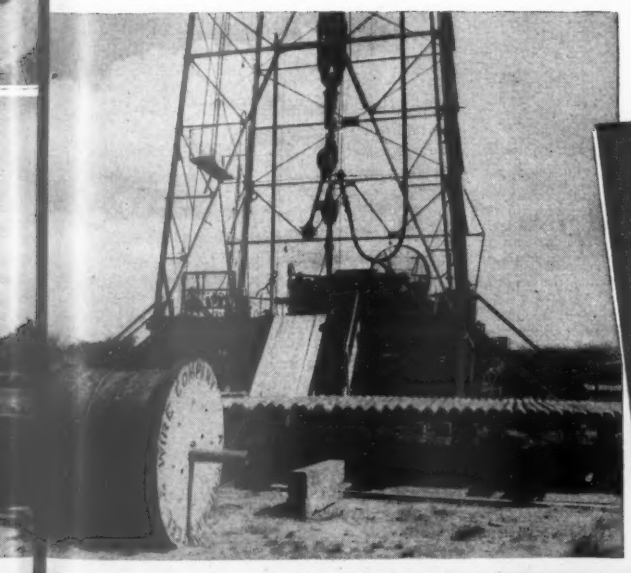

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Under the 1945 development program for the Amana (Mulata) field, 43 wells were completed during the 10 months to October 31, 1945, and 6 wells were drilling at that time. Five rigs are in operation, and it is expected that seven more wells will be completed by the end of this year. On October 31, 1945, a total of 144 wells had been drilled, of which 128 were oil producers, 6 gas producers, and 8 were dry holes. Two wells drilled in productive areas in 1944 were abandoned because of mechanical difficulties.

The exploitation program for 1946 calls for operation of five rigs during the first quarter of the year and three rigs for the remaining 9 months. It is anticipated that under this program the field will do better than maintain the productive potential of approximately 30,000 bbl. per day of 34° A.P.I.

In addition to this program, it is planned to operate during the last 9 months of 1946 one rig on deep exploratory drilling to determine the productive possibilities of yet unproven horizons.

The depth of wells in the Mulata field averages from 4,500 to 6,500 ft. Gross cumulative production of the Amana (Mulata) field to August 31, 1945, amounted to 14,676,005 bbl., of which Pantepec's net share approximates 40 per cent.

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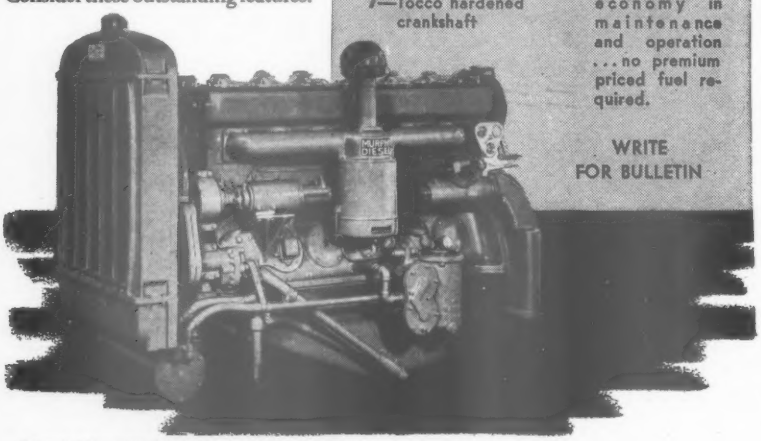

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El Roble Field

Production for joint Creole-Pantepec interest from the 10 wells in the El Roble field during the 10 months ending October 31, 1945, averaged 4,830 bbl. per day of 50° A.P.I.

Because of technical and engineering problems encountered in drilling, completing and operating the wells in the El Roble field, a special study of reservoir conditions and completion methods has been made before further drilling. Prof. John F. Dodge of the University of Southern California and Edwin O. Bennett of Houston, were engaged and made a study of the El Roble field, submitting an estimate of reserves and recommending operation methods. El Roble No. 11 will be spudded in shortly. In line with their recommendations, to determine the future drilling program, special personnel has been engaged and one rig will be used. It is anticipated that it will require 6 months to complete one test well.

The depth of wells in the El Roble field averages from 9,000 to 10,000 ft. Gross cumulative production of the El Roble field to August 31, 1945, amounted to 9,836,877 bbl., of which Pantepec's net share approximates 40 per cent.

TR-TRN (Temblador) Field

No drilling was undertaken in the TR-TRN field in 1944 and 1945, and none is planned for 1946. The seven wells in this field, reopened to production in March 1945, averaged until October 31, 1945, for joint account, 263 bbl. per day of 26° A.P.I.

The depth of wells in the TR-TRN field averages from 4,000 to 4,500 ft. Gross cumulative production of the TR-TRN (Temblador) field to August 31, 1945, amounted to 848,626 bbl., of which Pantepec's net share approximates 40 per cent.

Reserves

The Dodge-Bennett report referred to, estimates for the El Roble field an initial of 27,970,000 bbl. of developed and an additional 103,500,000 bbl. of proven but undeveloped reserves, or a total of 131,470,000 bbl. Of these, 9,836,877 bbl. had been produced by August 31, 1945. In addition, the report estimates the prospective reserves at 393,530,000 bbl. This figure was arrived at from the study of available geological and engineering data, but several exploratory wells will have to be drilled to determine this additional volume of recoverable oil.

The estimates for the Mulata field have not yet been released, but its proven reserves are estimated to be considerably in excess of the proven reserves for the El Roble field.

The estimated reserves in the Tabasco, TR and TRN fields are not considered extensive.

Therefore, Pantepec has a net interest approximating 40 per cent in fields which indicate an aggregate proven reserve of between 250,000,000 and 300,000,000 bbl., a large part of which is 50° A.P.I. This does not include the possibilities of new discoveries under the Creole and Atlantic agreements.

Pantepec was marged with other companies into a Venezuelan corporation in 1938, with a capitalization of Bs 12,000,000 ($3,840,000) represented by 3,000,000 shares.

At its inception in 1924 comparatively little was known of the oil possibilities of Venezuela. The company spent 7 years selecting acreage in western and eastern Venezuela aggregating approximately 3,000,000 acres.

Pantepec now owns an interest in 400,216 acres containing three producing oil fields and other areas where favorable geological structures or traps are known to exist.

The company's policy has been to enter into operating agreements with major companies. These have resulted in the development of substantial oil production and reserves.

Management

William F. Buckley organized the company in 1924 and has been president since its inception. In 1943, W. W. Smith, vice president and manager in Venezuela since 1924, was made president and general manager, Buckley remaining as director and assuming special duties as general agent in the United States.

For a number of years Henry Hinds was the company's chief geologist. The concessions were largely acquired on his recommendations. J. L. Barnett was secretary and treasurer from 1927 to 1938, when all of the company's interests were merged into the Venezuelan corporation. Since 1938 his services have been retained as special consultant in financial and accounting matters. In 1938 R. Pardo B., the company's office manager in Venezuela since 1929, became secretary and treasurer.

Recently, Professor Dodge, head of the department of petroleum engineering, U.S.C., joined the company as vice president and manager. F. H. Bailly, petroleum engineer, connected with the company since 1927, is the assistant manager.

Observing field operations for Pantepec under the Creole and Atlantic Refining operations are Spence T. Taylor and John T. Sinclair, Jr., geologist-engineers.

Synthetic Plant for Spain

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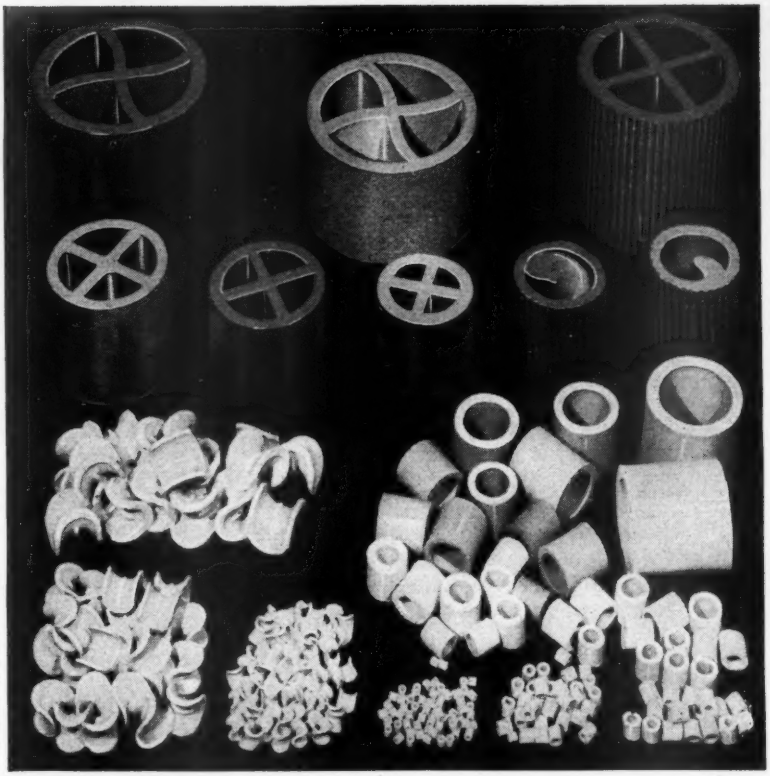

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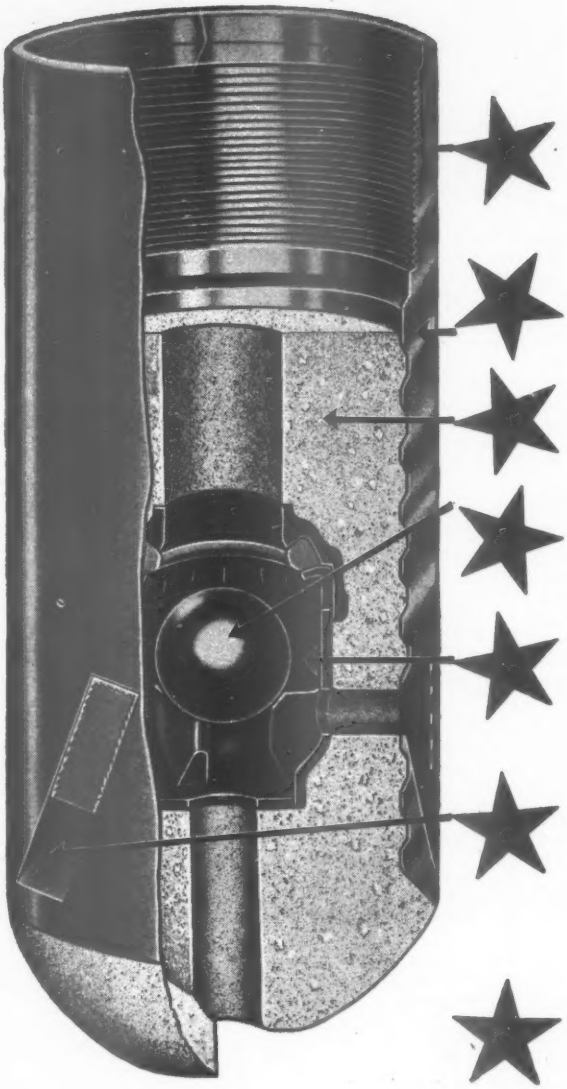

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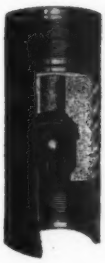
This is a BAKER Cement Float Collar

Product No. 101—also furnished with Male and Female Threads



Positioned one or two joints from bottom, it serves as a float valve; also as a stop for the cementing plug, thus retaining cement tailings inside the casing. It is run with a regular Guide Shoe, or a Whirler Guide Shoe in wells of average depth. In deeper wells it is good practice to use this Baker Float Collar with a Baker Cement Wash-Down Whirler Float Shoe, opposite page.

This is a BAKER Cement Guide Casing Shoe

Product No. 102

Generally used with a Baker Cement Float Collar, in wells of average depth, this Shoe is amply strong to guide the longest string of casing safely to bottom. The rounded nose readily passes any side wall irregularities. The plug of Baker-formula Concrete is easily drilled up and circulated out of the hole.

This is a BAKER Cement Wash-Down Whirler Guide Shoe

Product No. 121

Where bridges, or other formation obstructions are likely to be encountered, this Guide Shoe is used in combination with a Baker Cement Float Collar (above). The Wash-Down Whirler Guide Shoe then safely guides the casing past any wall irregularities, washing the side walls, breaking down bridges, and preparing the hole for a good cement job. When cementing is commenced the Guide Shoe whirls the slurry to uniformly encase the pipe.

Be prepared to perform a successful, "first-time" cement job in your next well. You will find complete details on BAKER CEMENT EQUIPMENT in the 1944 Composite (or Baker) Catalog; or TELEPHONE ANY OF THESE BAKER SERVICE LOCATIONS . . .

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Guiding, Floating and Cementing EVERY String of Casing

Rate of Oil Production for Decreasing Depletion Rates

THE OPTIMUM RATE OF PRODUCTION

*by Park J. Jones**

PART 18 OF A SERIES

IF pressure is not maintained, a substantial fraction of an initial reserve for some oil reservoirs may become marginal (stripper) reserve. The present value of a marginal reserve is negligible. The effect of a marginal reserve on optimum rates of production is similar to that of decreasing an initial reserve by an amount equal to the marginal reserve. Maintenance of well producing capacity by drilling a comparatively large number of wells decreases the size of a marginal reserve. However, production of oil by injection of gas or water may be more profitable than by the drilling of a comparatively large number of producing wells. From these viewpoints, decreasing rates of depletion are of interest to producers of oil. The rates of oil production which accompany some decreasing rates of depletion are illustrated in this article by examples.

Rate of Depletion vs. Cumulative Recovery

DENOTE the reserve recoverable at decreasing rates of depletion by unity. Let C equal cumulative recovery and R_o, the initial rate of depletion. Then the rate of production Q is defined by

$$Q = R_o (1 - C)^p \qquad (1)$$

where (1 — C) is the reserve at any time and p is an exponent depending on producing and operating methods. For uniform rates of depletion, p is equal to one. For decreasing rates of depletion, p is greater than unity. The initial rate of depletion R_o was defined, in Part 16 of this series, as $a/(1 - a)\,y$ where "a" is the cumulative recovery at the time production starts declining and y is the number of years during which "a" was accumulated.

As the rate of production is equal to the rate of depletion times reserve, we have

$$Q = R (1 - C) \qquad (2)$$

Upon eliminating Q between Equations 1 and 2, we obtain

$$R = R_o (1 - C)^{p-1} \qquad (3)$$

The curves in Fig. 18-1 are solutions of Equation 3. The rate of depletion, in per cent of the initial rate of depletion, is plotted against cumulative recovery for values of p equal to 1.5, 2, and 3. A uniform rate of depletion would be a horizontal line through 100 per cent in Fig. 18-1.

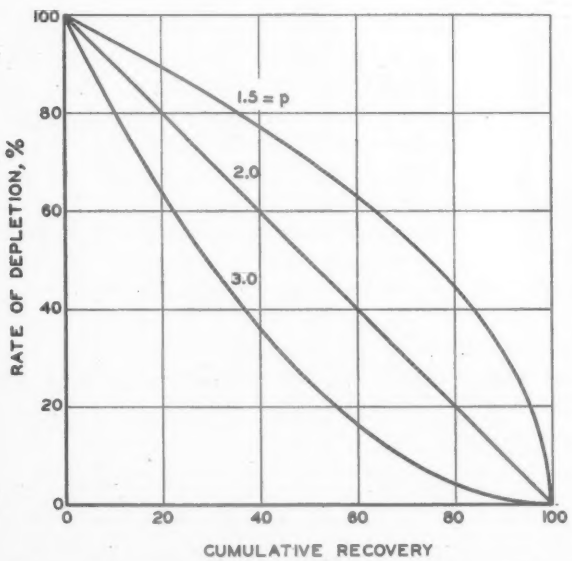
Rate of Production vs. Cumulative Recovery

The rates of production corresponding to the rates of depletion in Fig. 18-1 are illustrated in Fig. 18-2. The data in this figure are solutions of Equation 1. Rate of production is plotted against cumulative recovery. Rate of production is in per cent of the initial rate of production which is numerically equal to the initial rate of depletion R_o. Cumulative recovery is in per cent of the reserve at the time production starts declining.

Rate of Production Proportional to Square of Reserve

Consider a reservoir from which

*Production consultant, Houston.



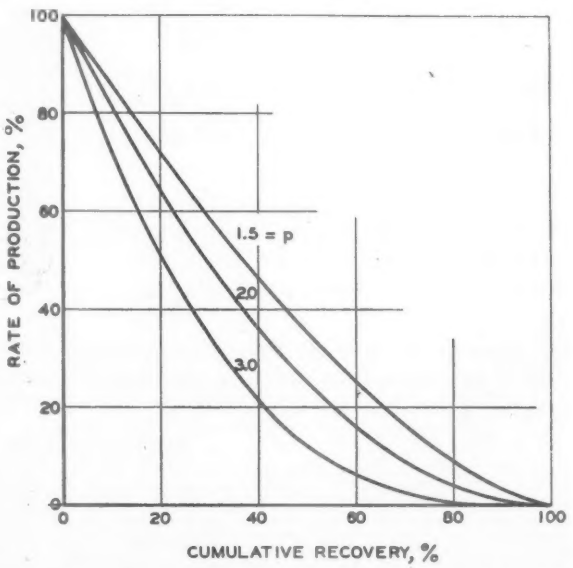


Fig. 18-1—(Left) Rate of depletion vs. cumulative recovery and exponent p; cumulative recovery in per cent of the reserve recoverable at declining rates of production; rate of depletion in per cent of the initial rate of depletion. Fig. 18-2—(Right) Rate of production vs. cumulative recovery and exponent p; cumulative recovery in per cent of the reserve recoverable at declining rates of production; rate of production in per cent of the initial rate of production

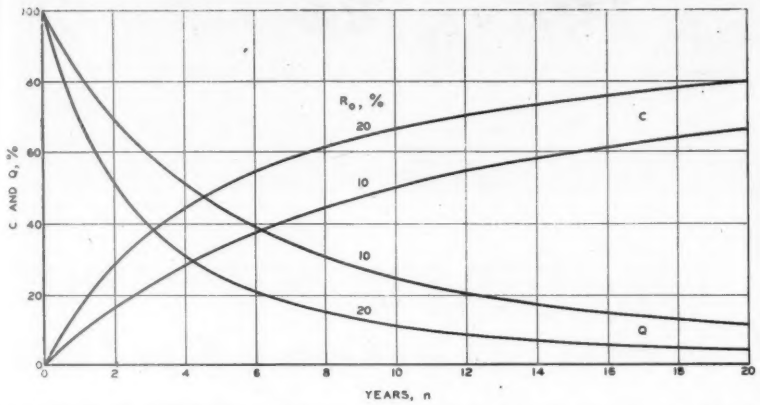


Fig. 18-3—Rate of production Q and cumulative recovery C vs. time in years for 10 and 20 per cent per year initial rates of production; C is in per cent of the reserve recoverable at declining rates; Q is in per cent of the initial rate of production; rate of production is proportional to the square of reserve

the rate of production is proportional to the square of reserve. For this condition, the cumulative recovery C at any time n is defined* by

$$C = \frac{R_o n}{1 + R_o n} \qquad (4)$$

To obtain the rate of production Q at any time n, we note from Equation 1 that

$$(1 - C) = \left(\frac{Q}{R_o}\right)^{0.5} \qquad (5)$$

Upon eliminating C between Equations 4 and 5, we obtain

$$Q = \frac{R_o}{(1 + R_o n)^2} \qquad (6)$$

The curves in Fig. 18-3 are solutions of Equations 4 and 6 for 10 and 20 per cent per year initial rates of production. Rate of production, in per cent of the initial rate, and cumulative recovery, in per cent of initial reserve, are plotted against time in years.

Example 1.—Estimate the producing conditions at the end of 5-year intervals for a 20-million-barrel initial oil reserve which is recoverable at rates proportional to the square of reserve. Solution from Fig. 18-3:

	Initial conditions	
Rate of production, per cent per year	10	20
Barrels per year	2,000,000	4,000,000
Barrels per day	5,480	10,960
	Conditions 5 years later	
Cumulative recovery, barrels	6,640,000	10,000,000
Producing rate, barrels per day	2,420	2,740
	Conditions 10 years later	
Cumulative recovery, barrels	10,000,000	13,330,000
Producing rate, barrels per day	1,370	1,220
	Conditions 15 years later	
Cumulative recovery, barrels	12,000,000	15,000,000
Producing rate, barrels per day	880	680
	Conditions 20 years later	
Cumulative recovery, barrels	13,330,000	16,000,000
Producing rate, barrels per day	610	440
Producing rate, barrels per year	223,000	154,600
Reserve, barrels	6,670,000	4,000,000

*See appendix to Article 17 of this series.

Rate of Production Proportional to Cube of Reserve

Consider an oil reservoir from which the rate of production is proportional to the cube of reserve. For this condition, the cumulative recovery C at any time n is defined* by

$$C = 1 - (1 + 2R_o n)^{-0.5} \qquad (7)$$

To obtain the rate of production Q at any time n, we note from Equation 1 that

$$(1 - C) = \left(\frac{Q}{R_o}\right)^{1/2} \qquad (8)$$

Upon eliminating C between Equations 7 and 8, we obtain

$$Q = \frac{R_o}{(1 + 2R_o n)^{1.5}} \qquad (9)$$

The curves in Fig. 18-4 are solutions of Equations 7 and 9 for 10 and 20 per cent per year initial rates of production. Rate of production, in per cent of the initial rate, and cumulative recovery, in per cent of initial reserve, are plotted against time in years.

Example 2.—Estimate the producing conditions at the end of 5-year intervals for a 20-million-barrel oil reserve which is recoverable at rates proportional to the cube of reserve. Solution from Fig. 18-4:

	Initial conditions	
Rate of production, per cent per year	10	20
Barrels per year	2,000,000	4,000,000
Barrels per day	5,480	10,960
	Conditions 5 years later	
Cumulative recovery, barrels	5,800,000	8,400,000
Producing rate, barrels per day	1,930	2,100
	Conditions 10 years later	
Cumulative recovery, barrels	8,440,000	11,070,000
Producing rate, barrels per day	1,040	980
	Conditions 15 years later	
Cumulative recovery, barrels	9,960,000	12,460,000
Producing rate, barrels per day	700	570
	Conditions 20 years later	
Cumulative recovery, barrels	11,070,000	13,330,000
Producing rate, barrels per day	490	400
Producing rate, barrels per year	179,000	146,000
Reserve, barrels	8,030,000	6,670,000

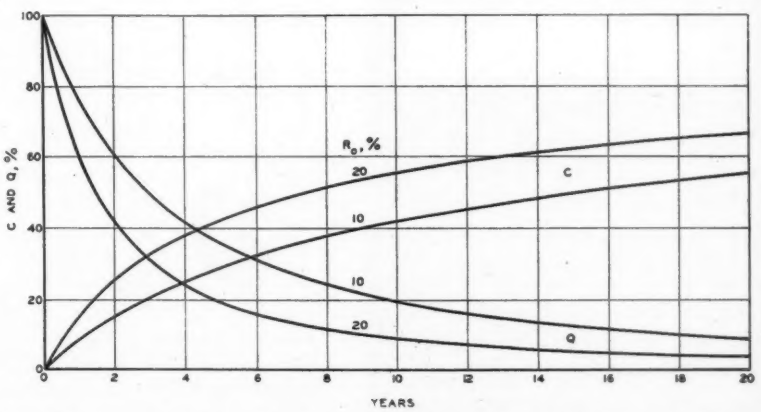


Fig. 18-4—Rate of production Q and cumulative recovery C vs. time in years for 10 and 20 per cent per year initial rates of production; C is in per cent of the reserve recoverable at declining rates; Q is in per cent of the initial rate of production; rate of production is proportional to the cube of reserve

Baash-Ross News

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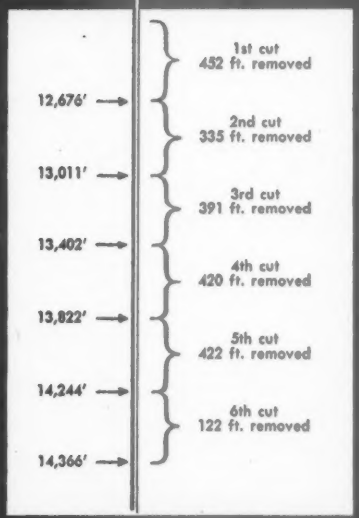

In one of the deepest cutting jobs ever made a Baash-Ross External Cutter started at 12,676 feet and in 6 uniform cuts completed the job at 14,366 feet. Note in chart the long length of the cut sections—and all approximately the same footage. Dependable recovery plus maximum pipe salvage . . . a *double Baash-Ross advantage!*

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Consistent Performance Like This Is Typical of

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The Baash-Ross job cited here is typical of the unusual dependability engineered into Baash-Ross cutting tools . . . typical of Baash-Ross runs being duplicated almost every day in wells throughout major oil producing territories of the world. It is different only in the extreme depth at which the cuts were made—proving that, *regardless of the depth,* here is an outside cutter you can *consistently* bank on to do the job right!

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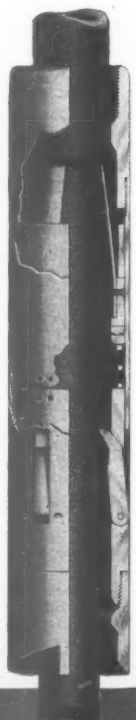
• **Exact Spacing** of each cut a short distance below the tool joint is another vital feature. This automatically safeguards against cutting at the thick-walled, hardened tool joints.

• **No Overshot** is needed because the Baash-Ross Cutter automatically supports the cut-off section for withdrawal from the hole. You cut and recover in *one* trip . . . with *one* tool!

• **Another advantage**—The same cutter body can easily be adapted for cutting pipe with collared joints—with external upset joints—or with external flush joints . . . an important export feature!



There's a Baash-Ross External Cutter for every size and type of outside cutting job—whether tubing, drill pipe or casing. Get the full details from your nearby Baash-Ross representative—or write direct. Pages 288-289 of your Composite Catalog also contain helpful data.

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Remaining Life of Reserve

The producing rate in barrels per year at the end of 20 years is shown in Examples 1 and 2. The reserve at the end of 20 years is also included. Suppose there were no further decline in the rate of production after 20 years. The number of years that would be required to accumulate the remaining reserve, at no further decline in the rate of production for the conditions of Examples 1 and 2, may be tabulated as follows:

RATE OF PRODUCTION PROPORTIONAL TO RESERVE

	Squared		Cubed	
Initial rate of production, % per year	10	20	10	20
Reserve at end of 20 years, million bbl.	6.67	4.0	8.03	6.67
Rate of production, 1,000 bbl./year	223	154.6	179	146
Remaining life, years	30	26	45	46
Rate of production, barrels per day	610	440	490	400

Even if there were no further decline in the rate of production after 20 years, the remaining life would range from 26 up to 46 years for the conditions of Examples 1 and 2. These conditions are not abnormal. The well producing capacity for numerous oil reservoirs is declining at rates which are even faster than those represented by Example 2.

Per Well Reserve at End of 20 Years

Suppose there are 50 wells for the 10 per cent per year initial rate of production and 100 wells for the 20 per cent per year initial rate of production. The initial conditions, and those 20 years later, would be as follows:

RATE OF PRODUCTION PROPORTIONAL TO RESERVE

	Squared		Cubed	
Initial rate of production, % per year	10	20	10	20
Number of wells	50	100	50	100
Initial reserve per well, 1,000 bbl.	400	200	400	200
Initial per well rate, bbl./day	110	110	110	110
Conditions 20 years later				
Average per well rate, bbl. per day	12.2	4.4	9.8	4.0
Average per well reserve, 1,000 bbl.	133	40	161	67

The reserve for the 100 wells averages 40,000 and 67,000 bbl. per well at the end of 20 years. But the rate of production from the wells averages only 4.4 and 4.0 bbl. per day respectively for the two examples under consideration. The remaining life of these reserves averages 26 years and 46 years respectively even if there were no further decline in well-producing capacity.

Injection of Gas or Water

Instead of 100 producing wells, suppose we drill only 50 producing wells and some gas, or water, injection wells. Let the rate of gas, or water, injection be sufficient to maintain rates of production proportional to reserve. The rate of production and cumulative recovery for a 10 per cent per year initial rate of production would then be as shown in Fig. 18-5.

Comparison of Producing Rates and Cumulative Recovery

The data of Fig. 18-5 may be compared at the end of 5-year intervals for a 20-million-barrel initial oil reserve as follows:

	Initial conditions		
	Injection	No injection	
Curves in Fig. 18-5	1	2	3
Number of producing wells	50	100	100
Average barrels per day per well	110	110	110
Conditions 5 years later			
Cumulative recovery, million barrels	7.88	10.00	8.40
Average barrels per day per well	66.5	27.4	21.0
Conditions 10 years later			
Cumulative recovery, million barrels	12.6	13.33	11.07
Average barrels per day per well	40.7	12.2	9.8
Conditions 15 years later			
Cumulative recovery, million barrels	15.56	15.00	12.46
Average barrels per day per well	24.6	6.8	5.7
Conditions 20 years later			
Cumulative recovery, million barrels	17.2	16.00	13.33
Average barrels per day per well	15.3	4.4	4.0
Barrels per day from reservoir	765	440	400

In the foregoing tabulation, we started with 50 producing wells and enough gas, or water, injection wells to maintain well producing capacity proportional to the reserve remaining at any time. At the end of 20 years, we accumulated 17,200,000 bbl. by injection. The rate of production at the end of 20 years is 765 bbl. per day from 50 wells.

For no injection, we started out with 100 producing wells. At the end of 20 years we accumulated 16,000,000 and 13,330,000 bbl. respectively for the two conditions here under consideration. The rate of production at the end of 20 years is 440 or 400 bbl. per day from 100 wells. The difference in oil recovery is 1,200,000 bbl. and 3,870,000 bbl. in favor of injection.

Under some conditions, production of oil by injection is more profitable than by drilling additional producing wells. If pressure is not maintained, a substantial fraction of an initial oil reserve may become marginal (stripper) reserve. The present value of a marginal reserve is negligible. The effect of a marginal reserve on optimum rates of production is similar to that of decreasing an initial reserve by an amount equal to the marginal reserve.

Robert M. Harris, president of Brighton Oil Co., **Carl von Bibra,** president of Exeter Oil Co. and **James S. Lawsche,** president of the Huntington Beach Co., have oil paintings on exhibition at the State Building in Exposition Park, Los Angeles.

W. R. Smeltzer has been named assistant manager of the marine department of Imperial Oil, Ltd., Toronto. He joined Imperial in 1917, became a master in 1918, in 1920 was named marine superintendent at Talara, Peru, and in 1934 manager of the operations division of the marine department.

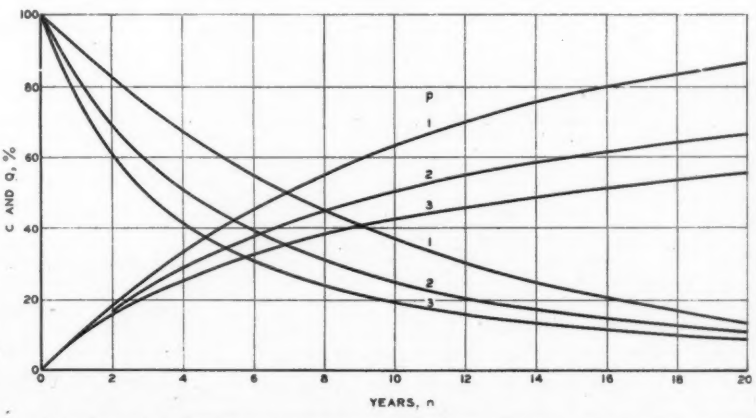

Fig. 18-5—Rate of production and cumulative recovery vs. time for a 10 per cent per year initial rate of production and rates of production proportional to (1) reserve, (2) square of reserve, and (3) cube of reserve; rate of production in per cent of the initial rate; cumulative recovery in per cent of the reserve recoverable at declining rates

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Fluid Flow

Graphic Solutions of Design Problems

11—Vertical Flow of Gases

by Paul Buthod and B. W. Whiteley

VERTICAL flow of gas in pipes is of frequent interest in the natural-gas and production branches of the petroleum industry. This type of problem is encountered in gas wells where the gas is produced either through the casing or tubing. More recently, gas-injection wells in pressure-maintenance programs and to a lesser extent in gas-storage projects, provide cases of practical interest for the downward flow of gases through vertical pipes. The usual type of flow equation for gases in horizontal surface lines leads to erroneous results for these cases of vertical flow since the elevation head is appreciable, especially for gases under high pressures.

The equations for flow of real gases through vertical pipes are as follows:

Vertical flow upward:

$$P_B^2 = B\,(P_T^2 + A) - A \qquad (11\text{-}1)$$

Vertical flow downward:

$$P_B^2 = B\,(P_T^2 - A) + A \qquad (11\text{-}2)$$

where:

$$A = 0.0000151\,\frac{Z^2T^2Q^2}{D^{5.33}}$$

$$B = e^{0.0.70\ sL/ZT}$$

Both equations 11-1 and 11-2 may be used to calculate the bottom-hole pressures in wells where the flow rate and surface pressure are known.

A specific example, using this type of calculation, arises in the determination of the open flow capacity of gas wells by the U. S. Bureau of Mines back-pressure test method.[1]

Essentially this test is conducted by producing the gas well at three or more stabilized rates of flow. The back pressure at the surface is recorded for each period, the gas being accurately measured by means of a critical flow prover.

The production rate follows a law of the form:

$$Q = C\,(P_f^2 - P_B^2)^n \qquad (11\text{-}3)$$

where "C" and "n" are constants (determined by two or more test points), P_f is the shut-in reservoir pressure and P_B is the pressure at the sand face corresponding to the production rate "Q."

Neither "P_f" or "P_B" are known and these values must be calculated indirectly from pressure measurements at the surface. If the well is shut in for a sufficient period to attain static conditions, "P_f" is calculated from the shut-in pressure at the top of the hole, correcting for the weight of the static gas column. This may be expressed as:

$$P_B = P_f = \sqrt{B}\,P_T \qquad (11\text{-}4)$$

(See Article 10)

The pressure at the bottom of the flow string "P_B" may be calculated by either one of two methods. If the well is produced through tubing, the casing head pressure can be measured, and corrected for the weight of the static gas column in the annular space by means of Equation 11-4. Otherwise it is necessary to calculate the bottom-hole pressure by means of the back pressure on the flow string at the surface, using Equation 11-1.

As proposed by Rawlins and Schellhardt[1] these calculations were performed, using Weymouth's flow formula and adding the weight of an equivalent static gas column.

This test method will be discussed in detail as an illustration of the calculations involved in the vertical flow of gas by the present equations.

Example. — Back-pressure flow tests were conducted on a gas well, the following data being measured.

TABLE I

Test	Q	P_T
1	0	3,010
2	1,600	2,996
3	3,512	2,950
4	4,895	2,902

The pressure "P_T" is the back-pressure on the critical flow prover, or the pressure at the top of the flow string. Additional data concerning the test are:

D = actual i.d. of tubing = 2.441 in.

L = length of flow string = 7,750 ft.

T = average flowing temperature = 100° F.

s = specific gravity of gas = 0.627

These data are sufficient to calculate the flowing bottom-hole pressure at each of the three flow rates as well as the static bottom-hole pressure.

To compute the static bottom-hole pressure, the average compressibility factor is used. For a 0.627 sp. gr. gas:[2]

$$T_R = 560/335 = 1.67$$

Assuming initially that the weight of the gas column is approximately 700 psi., the average pressure would be 3,360 psi. and:

$$P_R = 3{,}360/672 = 5.0$$

The compressibility factor for these pseudoreduced conditions is:

$$Z = 0.86$$

The value of $\sqrt{B}$ is calculated by means of Fig. 10-1 and is found to be:

$$\sqrt{B} = 1.21$$

Thus the static bottom-hole pressure corresponding to a surface pressure of 3,010 psi. is:

$$P_B = 1.21 \times 3{,}010 = 3{,}640 \text{ psi.}$$

The average pressure from the above calculated value is 3,325 psi. which does not change the initial assumed value for an average "Z."

The various values of P_B corresponding to the flow rates listed in Table 1 will be calculated using Equation 11-1. Since the compressibility factor is not very sensitive to small changes in pressure, the same value of "B" will be used and later checked.

The value of "A" may be determined from the accompanying chart (Fig. 11-1). For the first flow rate (Test No. 2), enter the chart on the bottom scale at a flow rate of 1,600 M.c.f./day. Rise vertically to a pipe diameter line of 2.44 in. and thence move horizontally to a compressibility factor line of 0.86. From this

Upward and downward flow of gas in vertical pipes and flow in inclined lines were discussed in Article 10 (December 22 issue). How the chart (Fig. 10-1) may be used in computing static bottom-hole pressures is illustrated in the solution of a practical example in the preceding article.

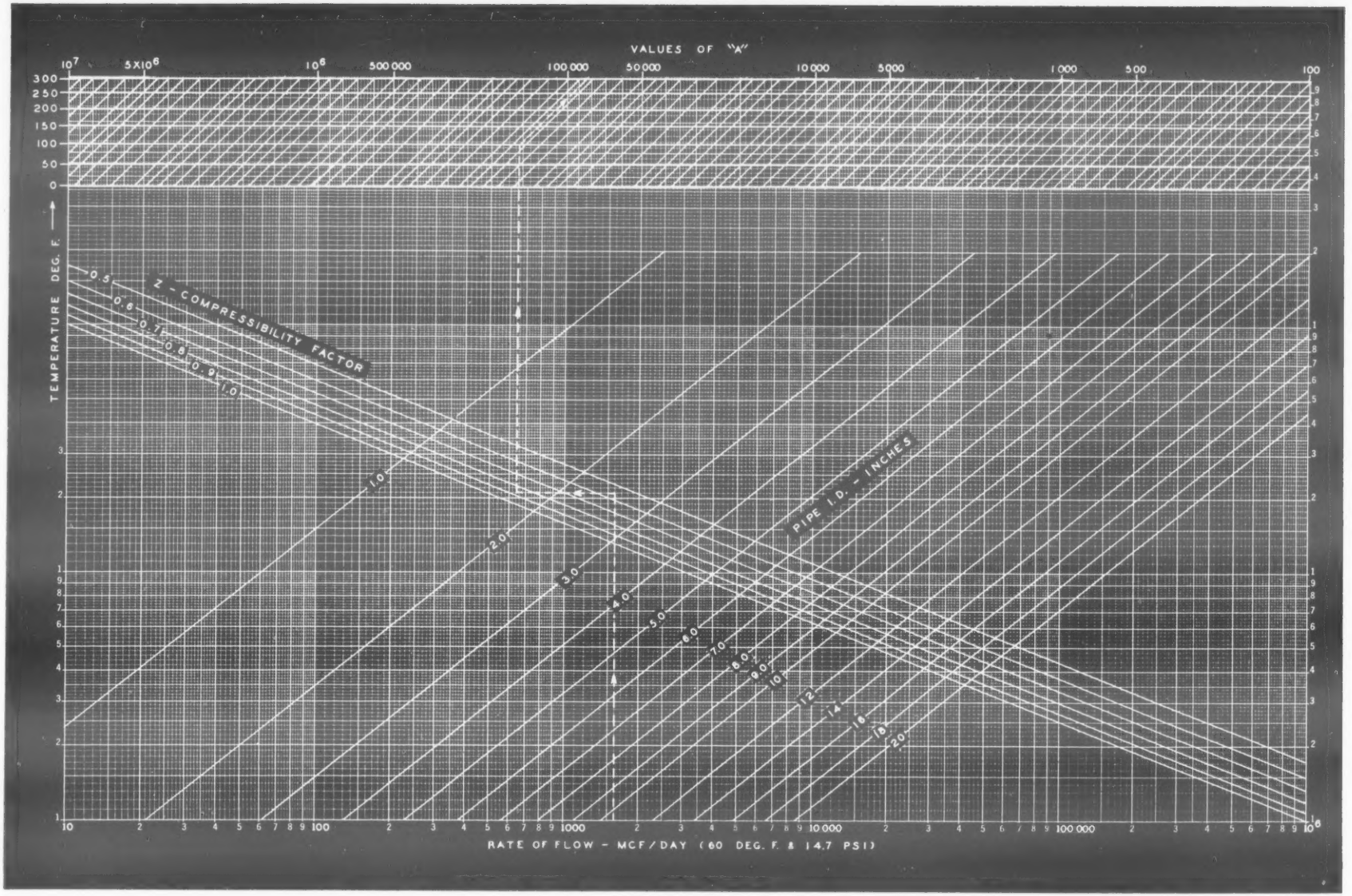
VALUES OF "A"
TEMPERATURE DEG. F.
Z - COMPRESSIBILITY FACTOR
PIPE I.D. - INCHES
RATE OF FLOW - MCF/DAY (60 DEG. F. & 14.7 PSI)

Fig. 11-1

Fig. 11-1

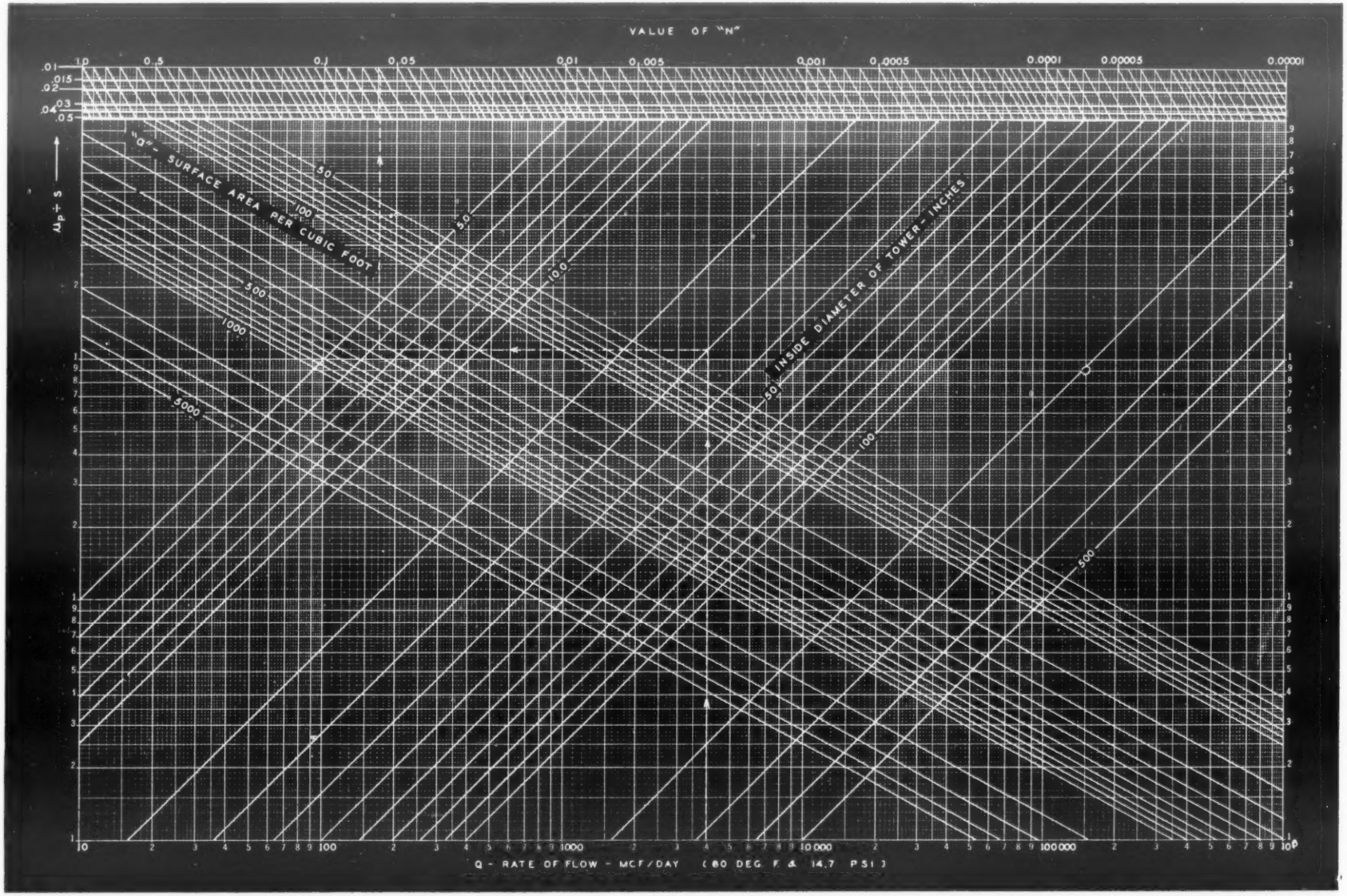

Fig. 11-2

When you use Filtrol* your lubricants attain that prized opalescence — the bloom that is the mark of quality which formerly distinguished only premium oils from certain producing areas.

Filtrol is a highly activated, chemically prepared adsorbent. Increased adsorptive quality permits fewer pounds of Filtrol to produce more gallons of better lube oils — quicker — with minimum handling, permitting a far greater filter capacity.

It is important for every lube oil refiner to consider now, whether his present methods are producing the volume and quality, to retain and develop the growing needs for more and better motor oil.

Filtrol Fractionation and Contact Filtration Units are not only delivering postwar quality today — but are doing it at minimum labor — minimum cost—highest quality—in great volume.

FILTROL CORPORATION

General Offices: 634 South Spring Street, Los Angeles 14
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point rise vertically to an average flowing temperature of 100° F. and following the diagonal guide lines, read a value for "A" of 84,100.

Thus the flowing bottom-hole pressure at this flow rate is:

$$P_B^2 = 1.462\,(2{,}996^2 + 84{,}100) - 84{,}100$$

$$P_B^2 = 13{,}176{,}900$$

and

$$P_B = 3{,}630 \text{ psia.}$$

Again the final result checks the assumed initial value for "Z" and recalculation using a corrected value for "Z" is not necessary.

The bottom-hole pressures at the two other flow rates are calculated in a similar manner. The results are indicated in Table 2.

TABLE 2

Test	Q	P_T	P_B	$P_f^2 - P_B^2$
1	0–	3,010	3,640	0
2	1,600	2,996	3,630	72,700
3	3,512	2,950	3,596	313,000
4	4,895	2,902	3,560	576,000

If "Q" is plotted against "$P_f^2 - P_B^2$" on logarithmic paper, the points fall on a straight line and this is the method ordinarily used in determining the open-flow capacity of the well. Defining the open-flow capacity as the value of "Q" corresponding to "$P_f^2 - 14.7^2$," the value of "n" and "C" in Equation 11-3 will be computed from values for Tests 2 and 4 in Table 2. The values for this simultaneous solution are:

$$n = 0.54$$

$$C = 3.79$$

Consequently the open-flow capacity of the well is:

$$Q = 3.79\,(3{,}640^2 - 14.7^2)^{0.54}$$

$$= 26{,}400 \text{ M.c.f./day}$$

Notation:

- C = numerical constant
- D = actual pipe i.d., in.
- L = length of flow string, ft.
- n = numerical constant
- P_T = pressure at top of vertical pipe, psia.
- P_B = pressure at bottom of vertical pipe, psia.
- P_f = static pressure at bottom of vertical pipe, psia.
- P_R = pseudoreduced pressure
- Q = flow rate, M.c.f./day (60° F. and 14.7 psia.)
- s = gas specific gravity (air = 1.000)
- T = average absolute flowing temperature, deg. Rankine
- T_R = pseudoreduced temperature
- Z = compressibility factor, dimensionless

References

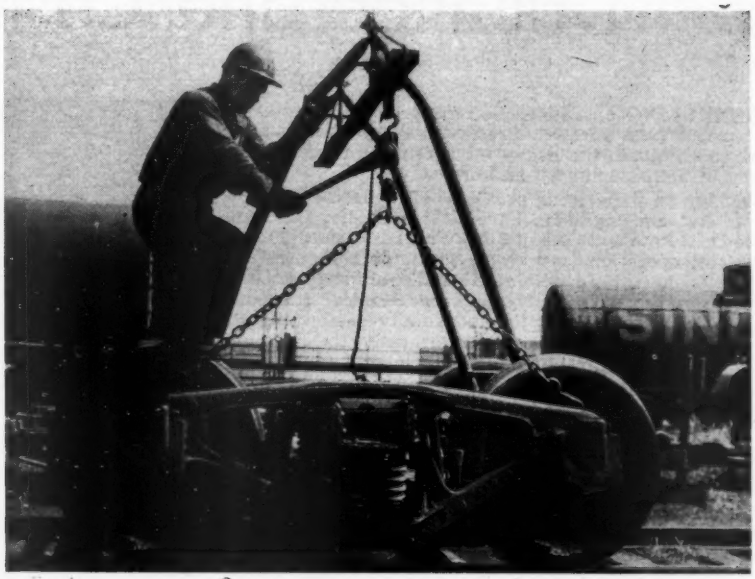
1. Rawlins, E. L., and Schellhardt, M. A., "Back Pressure on Natural-Gas Wells and Their Applications to Production Practices," USBM Monograph 7 (1936).

2. Brown, G. G., "Natural Gas Under Pressure," Proc. 19th annual convention, N.G.A.A., May 1940.

PLANT PRACTICES

Tilting Barrel Rack

SHOWN in the photograph is a handy tilting-type barrel rack which was built in the welding shop from salvaged materials. Used for storing light solvent in the car-repair department, the rack gives the advantage over a horizontal-type rack by eliminating spilling and valve leaking. Its particular value lies in the lessening of fire hazard in and around the storage areas.



Double "A" Frame Saves Time in Car Department

A DOUBLE "A" frame used in the car department saves many man hours and adds greatly to safe working conditions. A whole gang was formerly required to remove a side frame from a truck. By means of the frame shown in the illustration it is a simple operation to place the device in position on one side of the truck, raise the side frame with the chain hoist, run it clear on the rail and lower it to the ground. From the two large "A" frames a rail is suspended just under the apexes, and on this a chain hoist is mounted which travels along the rail. An eccentric type jack or "boomer" of the type shown in the photograph will be found to give ample clearance for freeing the side frame from the axle. In addition to using rigging for removing side frames, it may be used for assembly work.

Can-Lid Press Developed for Paper Cans

WHEN the war shortages made it impossible to procure metal cans it was necessary to use paper cans with metal tops and bottoms. These cans are equipped with a standard friction-type lid, but when the lid was tapped with a wooden mallet it failed to seat itself. When one side was tapped the other sprang up. A device was built that applies uniform pressure around the circumference of the lid. It consists of a base plate and two threaded pins which may be placed in one of several tapped holes and which are used to locate the various size cans. At the rear of the base is a post on which is suspended a bracket that is free to slide on the post. At the bottom of the bracket is a removable plate, which can be changed to fit the depression in the can cover. Pressure is applied to the plate, and the cover, by lowering the lever which is pinned to the post and to the bracket. A spring forces the lever back to its normal position when the handle is released. In operation the filled can is placed on the base plate against the pins under the pressure plate, the lid is placed in position on the can, and the lever is lowered.

(The ideas described here are used in the Marcus Hook and Houston refineries of Sinclair Refining Co.)

The New BJ Automatic Drill Pipe and Casing Slips

AS DRILLING operations become progressively deeper in search for petroleum reserves, every effort is being made to eliminate the heavy labor and improve the efficiency of both machinery and crews.

Working on the drilling problems of modern operations, Byron Jackson engineers have developed the BJ Automatic Drill Pipe and Casing Slips. Proved by over a year's successful operation, and by suggestions from the field, the "bugs" have been eliminated and these slips are now being offered to the industry as the satisfactory answer to the problem of conveniently and simply performing the major portion of the floor work. Naturally, the BJ Automatic Slips speed up the handling of long strings of pipe and contribute greatly to the increased safety of both men and equipment.

An unusually compact unit has been developed which is easy to install on any API rig; does not clutter up the derrick floor; is quickly placed in, or taken out of service and is under full control of the driller at all times. The unit is designed to operate on all types of rigs; and pneumatic actuation is recommended because of its efficiency and simple installation. If it is desired, steam or hydraulic power can be used, although requiring additional expensive equipment. Pneumatic power can be furnished by a simple connection of the "windjammer" on power rigs at normal pressure, or by the selection of a suitable compressor to handle volumes of 16 cubic feet and up, at 120 psi.

CONSTRUCTION OF BJ AUTOMATIC DRILL PIPE AND CASING SLIPS

The main elements of this mechanism consists of five parts:

(1) the cylinder used to raise, lower, or hold the slips in position;

(2) an arm or main body extending from the cylinder head and supporting the slip ring;

Fig. 1 *Automatic slips in raised position ready for placement around drill pipe.*

Fig. 2 *Stripping over pipe becomes unnecessary with the BJ Automatic Casing Slip hinged body.*

(3) the slip ring which is free to revolve within the body and supports the triple segment slips;

(4) two master bushing ring plate segments which serve to guide the slips into the master bushing, and

(5) a dual position, four-way control valve, located at the driller's post.

The two cylinders, on a heavy base plate, are mounted on the rotary table support beams directly in front of the drum and adjacent to the rotary table. The cylinder nearest the rotary table is the double acting pressure cylinder, while the other serves only as a guide or stabilizer for the mechanism. The use of a double acting system provides power to pull the slips into positive set position even when the pipe or casing is not centered in the opening. The cylinders extend above the derrick floor and are provided with a limit stop to compensate for variations in distances between the rotary table support beams, the derrick floor and the top of the rotary table.

A heavy plate tops the two cylinders and forms the base for the swivel plate and swivel. The swivel itself is extremely simple in construction and is heavy enough to withstand any ordinary abuse, and shear bolts are provided to prevent permanent damage in the event the elevators run into the unit. It is so designed that the main arm or body of the mechanism can be rotated to any desired position. Also attached to the base plate is the latch which is automatically locked when the mechanism is lowered into operating position and which must be manually released for swiveling.

The body or carrying arm is firmly mounted on the swivel by a heavy hinge pin and is held in horizontal position over the rotary table by a pin fitting into the grooved latch. The body and slip ring are both hinged and are designed for easy placement and removal on or off the pipe. All removable pins are mounted with strong chain.

Three slip segments are attached to the inner, or slip ring, by connecting links which allow for flexibility and

(An Advertisement)

Save Wear and Tear On Both Men and Equipment

Slips are "set" by means of the control valve at the driller's post. Fig. 4

permit easy removal of the slips. The complete slip ring is mounted on four anti-friction roller bearings attached to the body member, permitting full and free rotation of the ring and slips within the body. Slips are of the insert type, with inserts retained in bushings which are securely mounted to the slip body. Through the use of the proper bushing and inserts, sizes of from 2⅜" to 7" may be handled by one set of slips, eliminating the necessity of extra slip bodies. Means are provided for retaining the slip ring in the body when the door is opened for removing from or putting on pipe.

To provide a circular hole within the master bushing square, two half section master bushing rings are provided. These rings have a 30° bevel at the top, and serve to guide the slips and prevent them from "jumping out" when in raised position. The master bushing rings do not extend into the table opening to reduce its maximum diameter.

The control mechanism can be placed where desired, but field tests indicate foot control to be simplest and is, therefore, recommended. A four-way foot valve of popular make has been selected as most satisfactory and is so constructed that the slips are held in any desired position until released by the operator.

OPERATION OF BJ AUTOMATIC DRILL PIPE AND CASING SLIPS

When coming out of the hole, pipe is simply picked up high enough to clear the Kelly sub. The BJ master bushing rings are inserted and the unit positioned over the table in the following manner: power is admitted to the cylinder and the slip mechanism is picked up from out-of-service position to clear the rotary table. The cat line is then hooked onto the eye bolts provided on either side of the arm, and the body opened at one of the two hinging points, after making sure that the slip ring and the carrying arm segments are locked together. The latch is opened and the body is raised (Fig. 1) and swung into proper position and lowered around pipe (Fig. 2). Maximum opening provides ample clearance around the pipe. The body is closed and the chained hinge pins are reinserted, placing the slips in a working position (Fig. 3). Slips are then set (Fig. 4) by means of the control valve at the driller's post. Weight of the pipe is then assumed by the automatic slips and the joints can be broken. When the next stand of pipe is ready to be pulled, the pressure is admitted to the cylinder by the control valve and the slips rise to standing position as the pipe is pulled.

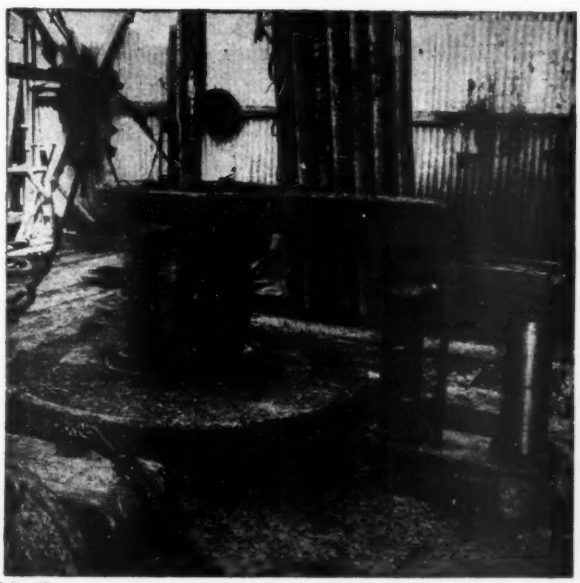
When going in the hole the slips are brought to standing position (Fig. 3). Bit and drill collars are lowered directly through the 16" opening in the slip ring until the elevator approaches the slip mechanism, at which time the control is actuated by the driller, and the slips are set (Fig. 4).

The automatic slips are so designed that any normal size drill pipe, tool joint, or pipe protector can be easily accommodated through the slip ring and the full opening of both slip ring and slips provides for safe handling of casing up to 7" OD without slowing down regular practice. Even if the drill pipe is dragging on the edge of the master bushing, full opening of the slips when in raised position, permits the free passage of any tool joints or protectors without danger of hanging up on the slips.

Purchase of the BJ Automatic Slips does not include compressor equipment, operating valves, hosing, piping, or installation, although on ordering, recommended hook-ups will be provided.

Additional information on the construction and operation of the BJ Automatic Drill Pipe and Casing Slips may be obtained from the Byron Jackson Co. Oil Tool Division, Post Office Box 2017, Terminal Annex, Los Angeles 54, California.

Illustration shows BJ Slips in "working position" i.e., with body closed and chained hinge pins inserted. Fig. 3



(An Advertisement)

PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Refinery Castings

FOUNDRYMEN who serve the petroleum-refinery industry and designers of refinery equipment will be interested in the high strength iron discussed on Page 7 of the Second Quarter Issue of Nickel Cast Iron News. Question arose as follows:

In producing fractionating columns and accessory parts in which 40,000-50,000-psi. tensile strength is specified, and the following "proposed" composition limits given: T.C., 2.70/3.10 per cent; Si, 1.10/1.70 per cent; Ni, 1.75/2.25 per cent; Cr, 0.35/0.60 per cent; Mn, 0.60/0.90 per cent; we are wondering if the low silicon and carbon contents will cause machining difficulties and would like to have your suggestions as to this and other features which might be helpful. Sections range from 1¾ down to ¼ in.

In answer the International Nickel Co. technologists replied: With regard to the heavy section castings, we do not believe your foundry will encounter any difficulty in meeting the specification. They will employ either a 40 or 60 per cent steel mixture to provide them with a low T.C. and low Si base iron. If the quantity of metal is large, the alloys or a substantial portion of them may be included in the cupola charge, while the balance is added at the spout.

On the lightweight and thin sectioned castings, some care may be necessary to keep them in a gray and machinable condition. It would be our recommendation that the composition be worked toward the soft side for such castings, namely, low in Cr and high in Si. If a 40 to 60 per cent steel mixture is used, for example, it would be desirable to aim for approximately 3.00 per cent C and 1.40 per cent Si going in, while an alloy content of about 1.50 per cent Ni and 0.50 Cr is included in the cupola charge. As this iron emerges at the cupola spout, it should be treated with about 1 per cent of the F-Nickel "B" inoculant which provides a powerful reaction in deoxidizing and inoculating the iron so that the chill is eliminated and the graphite organized into a desirable pattern.

The action of the inoculant in this direction is much greater than can be obtained by the use of nickel and silicon added as separate alloys. If a 1 per cent addition of it is made and the light section composition as outlined above is prepared with the C around 3.00 per cent, Si around 1.40 per cent, Ni around 1.50 per cent and Cr at about 0.50 per cent, the final values should finish up near 2.00 per cent Ni and 1.60 per cent Si. Some Cr and Si will be lost in the process, but the end values should remain well within specification and the castings should be gray and machinable.

We believe, then, that this adjustment in the specification will enable you to deliver the heavy castings without much change in your normal practice, and that the light-sectioned ones can be made from the same grade of iron if the indicated precautions are taken to maintain machinability.

Preparation of Cemented Carbide Specimens

FOR successful polishing of cemented carbides an abrasive should be used which, besides being angular in shape, is appreciably harder than the carbide itself. Diamond and boron carbide are the only two available abrasives meeting these requirements.

The simplest and quickest method depends on the use of accurately graded diamond powder, suitably mounted on rotating lapping wheels. Boron carbide is cheaper but does not have as rapid a cutting action.

The specimen should first be ground level, preferably wet, on the face of a green grit silicon carbide grinding wheel made specially for the grinding of cemented carbide. Three grades of diamond powder are sufficient to produce a suitable finish: 120 mesh, 400 mesh, and superfine, which has a grain size not exceeding that of two microns.

A hardwood disk fitted with a boss for mounting onto an electric motor or a metallographic polishing machine forms a good base for the diamond powder, which is applied with olive or nut oil. The speed of rotation is not critical, provided that it does not exceed a peripheral speed of 2,000 ft. per minute.

In etching, two main types of cemented carbides must be distinguished: Type 1—Tungsten carbide in a cobalt matrix; and Type 2—tungsten and titanium carbide in a cobalt matrix. There are some cemented carbides that do not respond well to the etching reagents given below and require a modified etching technique. However, the following procedures are satisfactory for the Type 1 and Type 2 carbides:

Type 1—etch electrolytically in a freshly made solution of 10 per cent caustic soda and 10 per cent potassium ferricyanide in water for 20 to 30 seconds with a two-volt accumulator. The tungsten carbide is attacked while the cobalt is not touched at all.

Type 2—etch in a mixture of equal volumes of concentrated nitric acid and hydrofluoric acid for 5 to 10 minutes. Cobalt is dissolved, leaving black outlines for the carbide grains; the titanium-bearing constituent is etched and appears brown, while the tungsten carbide particles are unattacked. A double etch may be given the Type 2 carbides, first with the hydrofluoric-nitric mixture and then with the alkaline ferricyanide to bring out the individual tungsten carbide grains. A 50 per cent nitric-acid solution in water is useful for bringing out the cobalt in fine-grained specimens.

A low-power microexamination of the polished surface at a magnification of 100 X is useful in assessing general porosity. Faulty polishing technique can make a good cemented carbide look very porous.

Type 1 carbides can usually be differentiated from Type 2 carbides, as they generally take a much higher polish. However, if this difference is not obvious, they can be distinguished by their specific density. Type 1 carbides will sink in mercury while Type 2 carbides float.

This abstract of "Metallography of Cemented Carbides," by D. H. Shute, Metal Treatment Vol. 12, Spring 1945, page 13, appeared in the August issue of Metals and Alloys.

Metallurgical Terms

Grains and Granulation

Grains of metal are irregular shaped patches of metal so small that they can be seen only by the use of a microscope, which exhibit a single orientation of crystals.

The formation of grains immediately upon solidification is called granulation.

Corronizing

A process for producing a composite coating consisting of a layer of nickel plated on a base metal, followed by a layer of zinc or tin, and finally a heat treatment at 500°-750° F. for times up to 6 hours. The coating adheres firmly and is said to last several times longer than a galvanized coating. It is used for fly screen, wire, fence wire, motor parts and wherever corrosion resistance is desired.

Polystyrene on Petroleum Horizon

by J. D. Constance

SUBSTANTIAL amounts of the styrene that goes into the processing of buna rubber come from petroleum sources. The question arises, What postwar possibilities does styrene possess when natural rubber returns to the peacetime picture again?

When heated slowly under controlled conditions of environment, styrene in the liquid state is polymerized and converted to solid polystyrene. This solid material when ground to a powder possesses properties which make it especially useful as a thermoplastic. Polystyrene can be molded, extruded, or shaped into rigid objects of many varieties and uses.

The story of polystyrene's development is as colorful as that of buna rubber. Styrene, so the story goes, was first isolated by Bonastre, a Frenchman, in 1831; but, not unlike a great many other discoveries, its real intrinsic value was not appreciated until almost 70 years later, in 1900, when a chemist by the name of Kronstein conducted extensive experiments to show that it could be used in the preparation of varnishes. Polystyrene, when mixed with rubber and other substances, shows a compatibility for compounding as expressed below:

In all proportions—Raw natural rubber, gutta-percha, butyl rubber (GR-I), buna-S (GR-S), polyisobutylene.

In limited proportions—Neoprene GN, butadiene-acrylonitrile rubbers, Thiokol FA organic polysulfide, paraffins, coumarone-indene resins.

Polystyrene imparts some toughness and hardness to rubber so that even as early as a few years just prior to World War I its use in that capacity was suggested to increase the life of tires.

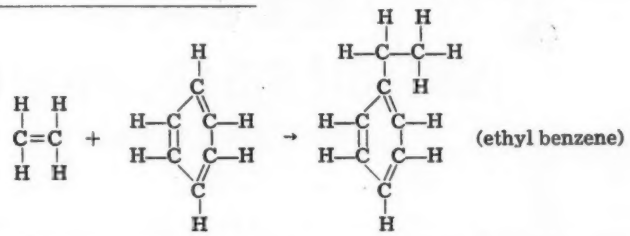
However, development of the rather expensive and impure material lagged, and any allusion to its possible uses was met with disinterest so that it held no real place in the line of materials which helped to win World War I. Interest in its possible use as an electrical insulating material was awakened shortly after hostilities ceased in 1918, but these were only flashes of interest and no attempt was made to carry on even though as late as 1933 some investigations were made in this country in order to improve its quality and methods of production with attendant lower costs. In spite of these failures it was felt that there existed an increasing need for a material of its kind that possessed excellent dielectric qualities.

In the face of the impossible, an attempt was made to produce a high-quality insulating material which could compete with the material imported from Germany at less than the import price of $1.25 per pound. Success was realized in 1937 and enough polystyrene of quality grade was made available to industry for further development purposes. Soon afterwards the material made its appearance as a molded plastic in the form of kitchen appliances, camera parts, lenses, parts of medical equipment, combs, and costume jewelry. Shortly before World War II was started, polystyrene was being offered to commercial molders at the low price of 30 cents a pound; and early in 1944 the price was further reduced to 27 cents a pound. This tremendous drop in price from $1.25 down to 27 cents, together with the advances made in the processing technique, represented real industrial progress.

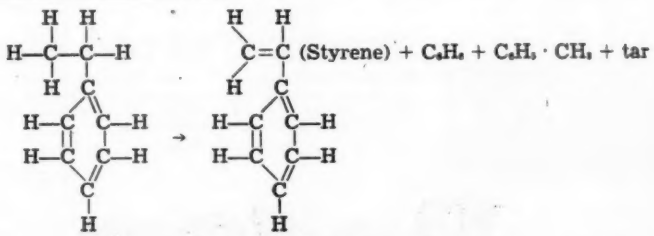
Styrene by Alkylation

Although styrene can be processed wholly from petroleum, it is made commercially from ethylene and benzene. The ethylene obtained for this purpose is usually carried over from cracking-still gases or from the direct cracking of propane; the benzene, from coal-tar plants.

The basic chemistry of the reaction is relatively simple. The most common processes utilize alkylation of benzene with ethylene to form ethyl benzene. The Dow process, which is used to produce a large percentage of the styrene demands for the rubber industry, cracks hydrocarbon gases such as ethane to form ethylene, $H_2C = CH_2$. The ethylene, which should be essentially free from propylene, is brought in contact with benzene in the presence of aluminum chloride as the catalyst. This is a low-temperature low-pressure process running around 200° F. and 15 psig. The reaction appears graphically:



In the arrangement of the benzene ring the top hydrogen atom is replaced by an ethyl group giving ethyl benzene. In this phase of the process sulfur has no adverse effect on the reaction, it appears, since hydrogen sulfide leaves the system after being formed by the action of the catalyst. This reaction is accompanied by the formation of diethyl and polyethyl benzenes. These side reaction products must be removed and the ethyl benzene sweetened and distilled. The benzene carried over in the reaction is recycled. The purified ethyl benzene is then dehydrogenated using superheated steam in the presence of a fixed bed catalyst. This takes place in a reactor and besides the styrene the other products formed are benzene, toluene, and tar. Thus:



In a distillation operation these byproducts are removed and styrene at 99.5 per cent purity or better is removed, injected with an inhibitor, and pumped to storage. An inhibitor is also injected into the distillation step, since under those conditions styrene shows a strong tendency to polymerize.

Polystyrene can be handled by

appropriate adaptation of any of the techniques normally used for thermoplastics. It can be formed into films, sheets, tubes, rods, tapes, and filaments or applied as an insulating material on wire by the familiar methods of extrusion. Sheeting can readily be made also by calendering, either unsupported or upon fabric, or by the block pressing technique. Polystyrene can be easily molded by compression or by injection in any of the standard commercial machines.

Polystyrene can be applied as a coating from a solution or emulsion, by the melt method, or by the flame spraying method. Where coating thicknesses up to about 3 mils the solution method is used. For heavier coatings, up to about 20 mils, the flame spraying technique is used. Thicker coatings may be applied by the melt method.

When the flame spraying method is used to coat objects, particles of the finely ground polystyrene are passed through a flame and are either softened on the surface or completely melted before they impinge on the surface to be coated. Successive layers are so applied that the entire coating becomes a nonporous homogeneous layer. Coatings of this kind have been deposited on metals, wood, glass, blick, plastics, and even paper. Tests have shown it to be extremely resistant to corrosion. Exposure to brines and chemicals have also shown these coatings to be protective over a 9-month period.

The use of polystyrene coatings for protective purpose on piping, reaction vessels, and containers, and as a gasketing material in contact with various acids, alkalies, and other chemicals has been developed. Hydrofluoric acid has been stored in bottles made of polystyrene.

The low moisture permeability and good water resistance of polystyrene indicate its successful application for the coating of cloth, paper, wood, brick, and concrete. Containers made from this material can hold milk and other liquids, and for packaging in general. In this application the material can be used in sheeting form or as an impregnant for paper.

Polystyrene, in addition to its many uses on electronic equipment, optical equipment and its extended use on chemical resistant equipment, is being developed for new molding, impregnating, and coating techniques. Heretofore, rigid, large-size structural molding using polystyrene as the impregnating material with fabric or glass laminations was impossible. Now laminated structures of almost unlimited size can be molded under vacuum and heat.

A limiting factor affecting its field of application is polystyrene's upper limit of operation temperatures. At temperatures over 180° F. a definite deformation of shape takes place so that it is not recommended for its use under such conditions. However, in a search for greater markets new compounds based on styrene are being developed to increase this top limit of operating temperatures.

Economic Aspects

The injection molding industry looks to polystyrene as its standard general-purpose thermoplastic molding material in the postwar period. Material costs are lower than ever before. They are now far lower than any competitive material and it may be noted that polystyrene is suitable for a majority of injection molding applications. The increased demand by injection molders will become effective about 2 years after construction of equipment for civilian production is authorized. The planning stage for polymerization and molding capacity is past the embryonic state in the industry and in many instances equipment is actually on order.

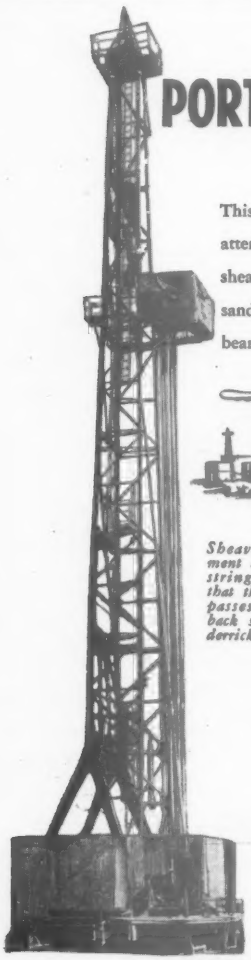
The precise level at which the rubber industry will be operated will have an important effect in determining the price and availability of styrene. Nevertheless, styrene is a material of promise regardless of the scope of the chemical rubber industry in the postwar period.

REGAN

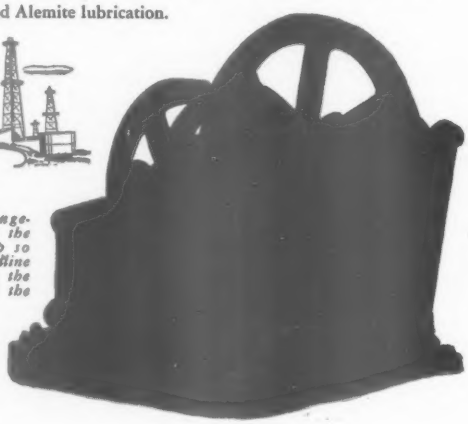
PORTABLE RIG CROWN BLOCK

200 TON CAPACITY

This newly featured portable rig crown block has attracted much attention among oil operators everywhere. It has a 48-inch fast sheave; 36-inch main sheaves; 26-inch dead line sheave; 18-inch sand and catline sheaves. This model has the regular REGAN dual bearing and Alemite lubrication.



Sheave arrangement allows the stringing up so that the deadline passes down the back side of the derrick.



CROWN BLOCKS FOR EVERY CONDITION

REGAN'S well-known line of crown blocks covers every condition encountered in any oil field. Forty-two years of experience in the construction of quality oil field equipment places the REGAN CROWN BLOCKS at the top of the equipment field.

Information will be sent on request.

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Quality Wrought on the Forge of Experience

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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Sulfuric-Acid Solutions

Weight per cent H_2SO_4	Sp. gr. at 20° C.	Gravity deg. Be.*	Lb. H_2SO_4 per gal.	Grams H_2SO_4 per liter
1	1.0051	0.7	0.0839	10.05
2	1.0118	1.7	0.1689	20.24
3	1.0184	2.6	0.2550	30.55
4	1.0250	3.5	0.3422	41.00
5	1.0317	4.5	0.4305	51.59
6	1.0385	5.4	0.5200	62.31
7	1.0453	6.3	0.6106	73.17
8	1.0522	7.2	0.7025	84.18
9	1.0591	8.1	0.7955	95.32
10	1.0661	9.0	0.8897	106.6
11	1.0731	9.9	0.9851	118.0
12	1.0802	10.8	1.082	129.6
13	1.0874	11.7	1.180	141.4
14	1.0947	12.5	1.279	153.3
15	1.1020	13.4	1.379	165.3
16	1.1094	14.3	1.481	177.5
17	1.1168	15.2	1.584	189.9
18	1.1243	16.0	1.689	202.4
19	1.1318	16.9	1.795	215.0
20	1.1394	17.7	1.902	227.9
21	1.1471	18.6	2.010	240.9
22	1.1548	19.4	2.120	254.1
23	1.1626	20.3	2.231	267.4
24	1.1704	21.1	2.344	280.9
25	1.1783	21.9	2.458	294.6
26	1.1862	22.8	2.574	308.4
27	1.1942	23.6	2.691	322.4
28	1.2023	24.4	2.809	336.6
29	1.2104	25.2	2.929	351.0
30	1.2185	26.0	3.051	365.6
31	1.2267	26.8	3.173	380.3
32	1.2349	27.6	3.298	395.2
33	1.2432	28.4	3.424	410.3
34	1.2515	29.1	3.551	425.5
35	1.2599	29.9	3.680	441.0
36	1.2684	30.7	3.811	456.6
37	1.2769	31.4	3.943	472.5
38	1.2855	32.2	4.077	488.5
39	1.2941	33.0	4.212	504.7
40	1.3028	33.7	4.349	521.1
41	1.3116	34.5	4.488	537.8
42	1.3205	35.2	4.628	554.6
43	1.3294	35.9	4.770	571.6
44	1.3384	36.7	4.914	588.9
45	1.3476	37.4	5.061	606.4
46	1.3569	38.1	5.209	624.2
47	1.3663	38.9	5.359	642.2
48	1.3758	39.6	5.511	660.4
49	1.3854	40.3	5.665	678.8
50	1.3951	41.1	5.821	697.6
51	1.4049	41.8	5.979	716.5
52	1.4148	42.5	6.140	735.7
53	1.4248	43.2	6.302	755.1
54	1.4350	44.0	6.467	774.9
55	1.4453	44.7	6.634	794.9
56	1.4557	45.4	6.803	815.2
57	1.4662	46.1	6.974	835.7
58	1.4768	46.8	7.148	856.5
59	1.4875	47.5	7.324	877.6
60	1.4983	48.2	7.502	899.0
61	1.5091	48.9	7.682	920.6
62	1.5200	49.6	7.865	942.4
63	1.5310	50.3	8.049	964.5
64	1.5421	51.0	8.236	986.9
65	1.5533	51.7	8.426	1010.0
66	1.5646	52.3	8.618	1033.0
67	1.5760	53.0	8.812	1056.0
68	1.5874	53.7	9.008	1079.0
69	1.5989	54.3	9.207	1103.0
70	1.6105	55.0	9.408	1127.0
71	1.6221	55.6	9.611	1152.0
72	1.6338	56.3	9.817	1176.0
73	1.6456	56.9	10.02	1201.0
74	1.6574	57.5	10.24	1226.0
75	1.6692	58.1	10.45	1252.0
76	1.6810	58.7	10.66	1278.0
77	1.6927	59.3	10.88	1303.0
78	1.7043	59.9	11.09	1329.0
79	1.7158	60.5	11.31	1355.0
80	1.7272	61.1	11.53	1382.0
81	1.7383	61.6	11.75	1408.0
82	1.7491	62.1	11.97	1434.0
83	1.7594	62.6	12.19	1460.0
84	1.7693	63.0	12.40	1486.0
85	1.7786	63.5	12.62	1512.0
86	1.7872	63.9	12.83	1537.0
87	1.7951	64.2	13.03	1562.0
88	1.8022	64.5	13.23	1586.0
89	1.8087	64.8	13.43	1610.0
90	1.8144	65.1	13.63	1633.0
91	1.8195	65.3	13.82	1656.0
92	1.8240	65:5	14.00	1678.0
93	1.8279	65.7	14.19	1700.0
94	1.8312	65.8	14.36	1721.0
95	1.8337	65.9	14.54	1742.0
96	1.8355	66.0	14.70	1762.0
97	1.8364	66.0	14.87	1781.0
98	1.8361	66.0	15.02	1799.0
99	1.8342	65.9	15.15	1816.0
100	1.8305	65.8	15.28	1831.0

*Baume scale for liquids heavier than water.

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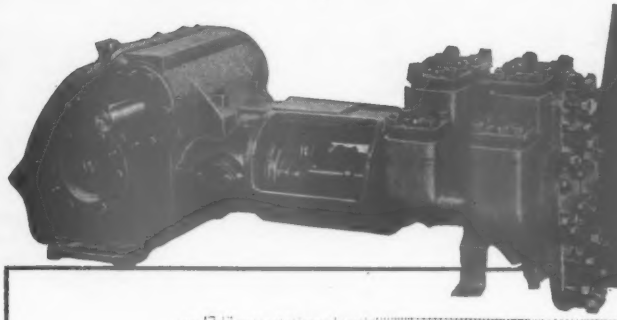

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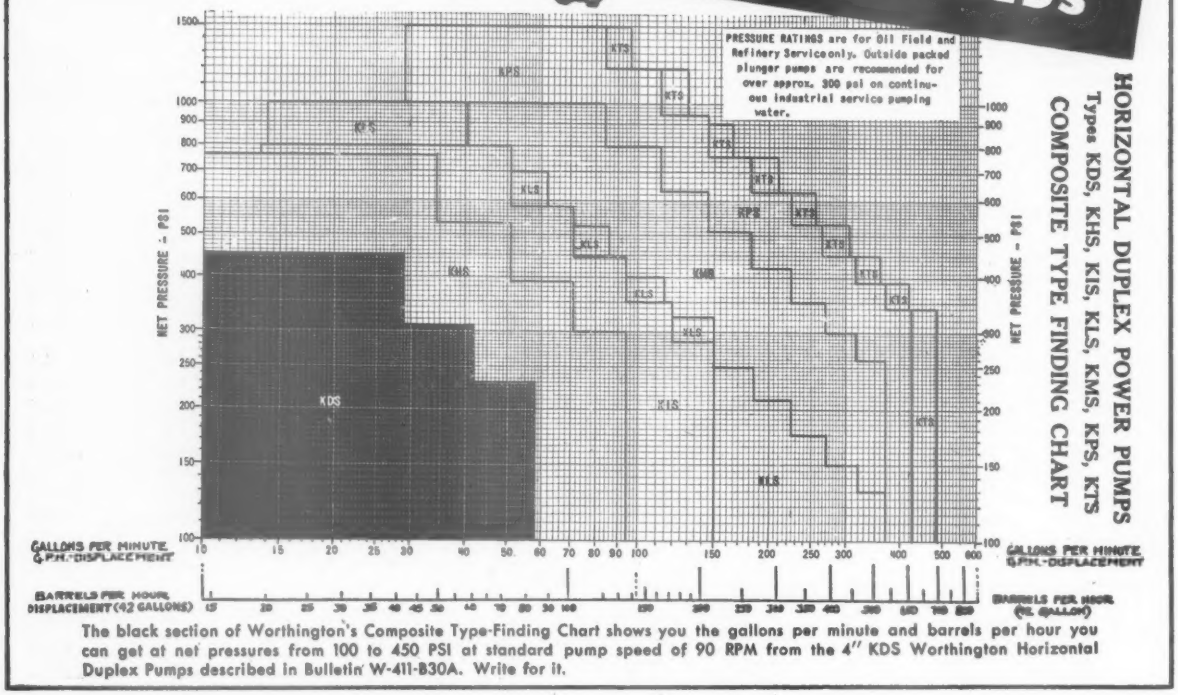
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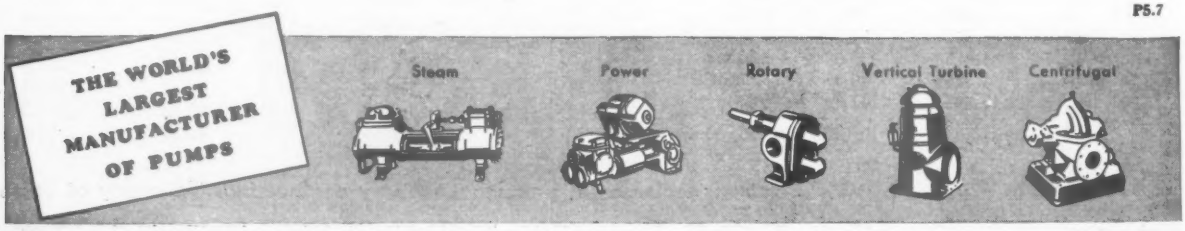


A FEATURE OF THE OIL AND GAS JOURNAL

Estimate Factors Increase Efficiency Of Chart Computation

THE time required for estimating the flow on unrecorded portions of orifice meter charts can be reduced considerably with an increase in efficiency through the use of factors constructed for this purpose.

Application of these factors to the volume computed from the recorded portion of the chart will result in an estimate which would ordinarily be obtained by dividing the recorded flow by the number of recorded hours, and multiplying the result by the number of unrecorded hours.

For example: A 24-hour chart indicates a flow for 18½ hours, and it is necessary to estimate the remainder of the chart based on the recorded flow period. Assuming the computed delivery for 18½ hours to be 525 M.c.f., the estimated remaining 5½ hours is obtained by application of the factor in Table 1 .2973 × 525 = 156 M.c.f. This same result is usually obtained by the following procedure:

525 ÷ 18½ = 28.378 M.c.f. per hour

28.378 × 5½ = 156 M.c.f. estimated

By the use of the factors in Table 1 for 24-hour charts and Table 2 for 7-day charts the possibility of decimal errors is greatly reduced, and the time required for calculation is reduced to less than one-half over present methods.

The tables are limited for use on charts which are intended to record full 24-hour or 7-day periods.

TABLE 1—FACTORS FOR ESTIMATING UNRECORDED PERIODS OF 24-HOUR CHARTS

Unrecorded period hrs.	Factor	Unrecorded period hrs.	Factor
¼	.0105	12¼	1.0426
½	.0213	12½	1.0870
¾	.0323	12¾	1.1333
1	.0435	13	1.1818
1¼	.0549	13¼	1.2326
1½	.0667	13½	1.2857
1¾	.0787	13¾	1.3415
2	.0909	14	1.4000
2¼	.1034	14¼	1.4615
2½	.1163	14½	1.5263
2¾	.1294	14¾	1.5946
3	.1429	15	1.6667
3¼	.1566	15¼	1.7429
3½	.1707	15½	1.8235
3¾	.1852	15¾	1.9091
4	.2000	16	2.0000
4¼	.2152	16¼	2.0968
4½	.2308	16½	2.2000
4¾	.2468	16¾	2.3103
5	.2632	17	2.4286
5¼	.2800	17¼	2.5556
5½	.2973	17½	2.6923
5¾	.3151	17¾	2.8400
6	.3333	18	3.0000
6¼	.3521	18¼	3.1739
6½	.3714	18½	3.3636
6¾	.3913	18¾	3.5714
7	.4118	19	3.8000
7¼	.4328	19¼	4.0526
7½	.4545	19½	4.3333
7¾	.4769	19¾	4.6471
8	.5000	20	5.0000
8¼	.5238	20¼	5.4000
8½	.5484	20½	5.8571
8¾	.5738	20¾	6.3846
9	.6000	21	7.0000
9¼	.6271	21¼	7.7273
9½	.6552	21½	8.6000
9¾	.6842	21¾	9.6667
10	.7143	22	11.0000
10¼	.7455	22¼	12.7143
10½	.7778	22½	15.0000
10¾	.8113	22¾	18.2000
11	.8462	23	23.0000
11¼	.8824	23¼	31.0000
11½	.9200	23½	47.0000
11¾	.9592	23¾	95.0000
12	1.0000		

TABLE 2—FACTORS FOR ESTIMATING UNRECORDED PERIODS OF 7-DAY CHARTS

Unrecorded period hrs.	Factor	Unrecorded period hrs.	Factor
1	.0060	85	1.0241
2	.0120	86	1.0488
3	.0182	87	1.0741
4	.0244	88	1.1000
5	.0307	89	1.1266
6	.0370	90	1.1538
7	.0435	91	1.1818
8	.0500	92	1.2105
9	.0566	93	1.2400
10	.0595	94	1.2703
11	.0701	95	1.3014
12	.0769	96	1.3333
13	.0839	97	1.3662
14	0909	98	1.4000
15	.0980	99	1.4348
16	.1053	100	1.4706
17	.1126	101	1.5075
18	.1200	102	1.5455
19	.1275	103	1.5846
20	.1351	104	1.6250
21	.1429	105	1.6667
22	.1507	106	1.7079
23	.1586	107	1.7541
24	.1667	108	1.8000
25	.1748	109	1.8475
26	.1831	110	1.8966
27	.1915	111	1.9474
28	.2000	112	2.0000
29	.2086	113	2.0545
30	.2174	114	2.1111
31	.2263	115	2.1698
32	.2353	116	2.2308
33	.2444	117	2.2941
34	.2537	118	2.3600
35	.2632	119	2.4286
36	.2727	120	2.5000
37	.2824	121	2.5745
38	.2923	122	2.6522
39	.3023	123	2.7333
40	.3125	124	2.8182
41	.3228	125	2.9070
42	.3333	126	3.0000
43	.3440	127	3.0976
44	.3548	128	3.2000
45	.3659	129	3.3077
46	.3770	130	3.4211
47	.3884	131	3.5405
48	.4000	132	3.6667
49	.4118	133	3.8000
50	.4237	134	3.9412
51	.4359	135	4.0909
52	.4483	136	4.2500
53	.4609	137	4.4194
54	.4737	138	4.6000
55	.4867	139	4.7931
56	.5000	140	5.0000
57	.5135	141	5.2222
58	.5273	142	5.4615
59	.5413	143	5.7200
60	.5556	144	6.0000
61	.5701	145	6.3043
62	.5849	146	6.6364
63	.6000	147	7.0000
64	.6154	148	7.4000
65	.6311	149	7.8421
66	.6471	150	8.3333
67	.6634	151	8.8824
68	.6800	152	9.5000
69	.6970	153	10.2000
70	.7143	154	11.0000
71	.7320	155	11.9231
72	.7500	156	13.0000
73	.7684	157	14.2727
74	.7872	158	15.8000
75	.8065	159	17.6667
76	.8261	160	20.0000
77	.8462	161	23.0000
78	.8667	162	27.0000
79	.8876	163	32.6000
80	.9091	164	41.0000
81	.9310	165	55.0000
82	.9535	166	83.0000
83	.9765	167	167.0000
84	1.0000		

Natural Gas

Oral Arguments Set for Northern Natural Project

WASHINGTON.—Oral arguments on applications filed by Northern Natural Gas Co. of Omaha for authority to construct facilities to enable it to meet winter requirements of customers in Iowa, Kansas, and Nebraska will be heard by Federal Power Commission at a hearing January 5. The oral arguments will be heard in lieu of filing reply briefs to enable the commission to dispose of the matter more quickly.

Additional facilities which the company proposes to build include 20 miles of 20-in. loop extending north from its Odgen, Ia., compressor station; 10 miles of 24-in. loop extending northeasterly from a point about 24 miles northeast of its Mullinville, Kans., compressor station in continuation of an existing loop; 7 miles of 24-in. loop extending northeasterly in continuation of an existing loop in the vicinity of the Bushton compressor station, and 13½ miles of 24-in. line extending southwesterly from the company's Beatrice, Neb., compressor station. Total cost of the projects will be $1,407,748.

Prior Approval Required For New Gas Projects

WASHINGTON.—Notice has been issued by Federal Power Commission calling attention of all interstate natural-gas companies to the requirement of Section 7, Natural Gas Act of 1938, that prior authorization must be obtained for construction and operation of all new facilities. Appropriate action will be taken against any company violating this provision, the notice warned.

"During the war," the notice pointed out, "when the availability of materials and equipment was under the control of and subject to directives of special war agencies, the issuance of temporary certificates by this commission was justified from time to time in order to meet situations created by the rapidly increasing demands of war industries. However, the cessation of hostilities has changed that situation. Materials are now available that could not be obtained during the war.

"The commission realizes that the problems of the reconversion period came upon the industry suddenly, but believes that the natural-gas companies should now be able to plan their construction programs for the reasonable future so as to avoid the filing of multiple applications involving portions of what are essentially single extension projects."

Commission Sets Hearing For Panhandle Eastern

WASHINGTON.—Panhandle Eastern Pipe Line Co. has been ordered by Federal Power Commission to show cause at a hearing, set for January 7, why (1) its proposed service of natural gas to Ford Motor Co. at Dearborn, Mich., will not impair its ability to provide adequate service to present consumers, and violate orders of the commission authorizing the construction and limiting the operation of certain facilities under Section 7 of the Natural Gas Act, and why (2) application should not be made under that act for the construction and operation of the pipeline facilities required for the interstate transportation of natural gas to the Ford company.

The commission also has instituted an investigation, following a complaint filed by the city of Detroit and Wayne County, Michigan, into the lawfulness of all contracts restricting the supply of natural gas, subject to FPC jurisdiction, by Panhandle to Michigan Consolidated Gas Co. for resale or underground storage in Michigan. The order states that if, after hearing, the restrictive contracts are found to be unjust or unlawful the commission will fix the terms to be observed thereafter.

Estimates on Natural-Gas Reserves to Be Available

Authoritative and dependable estimates of natural-gas reserves in each of the five gas-producing regions of the country, as well as for the entire nation will be available to the gas industry, to utility analysts, to investors and to the consubming public, N. C. McGowen, president of United Gas Pipe Line Co., Shreveport, La., and chairman of the committee on natural-gas reserves, announced after the organization meeting of his committee.

Regional committees will be appointed by chairmen designated by McGowen to compile accurate estimates of natural gas reserves for the five territories, which will correspond to the Districts of the Petroleum Administration for War. These regional committees, headed by members of the A.G.A. committee on Natural Gas Reserves, will be made up of outstanding experts in geological and natural-gas circles.

Ernest E. Roth, geologist, United Fuel Gas Co., Charleston, W. Va., will form the subcommittee for Region 1, comprising Kentucky, New York, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia.

Charles O. Hoffman, superintendent, land, lease and geological department, Cities Service Gas Co., Oklahoma City, will head District 2, including Illinois, Indiana, Kansas, Michigan, Missouri, North Dakota, Oklahoma and South Dakota.

R. O. Garrett, Arkansas Louisiana Gas Co., Shreveport; Perry Olcott, Humble Oil & Refining Co., Houston, and Paul C. White, vice president, South West Gas Producing Co., New York City, will form the subcommittee for District 3, covering Arkansas, Florida, Louisiana, Mississippi, New Mexico and Texas.

W. T. Nightingale, vice president, Mountain Fuel Supply Co., Rock Springs, Wyo., will appoint the subcommittee for District 4, comprised of Colorado, Montana, Utah, and Wyoming, and Roy M. Bauer, gas supply supervisor, Southern California Gas Co., Los Angeles, will form a subcommittee for California, which comprises District 5.

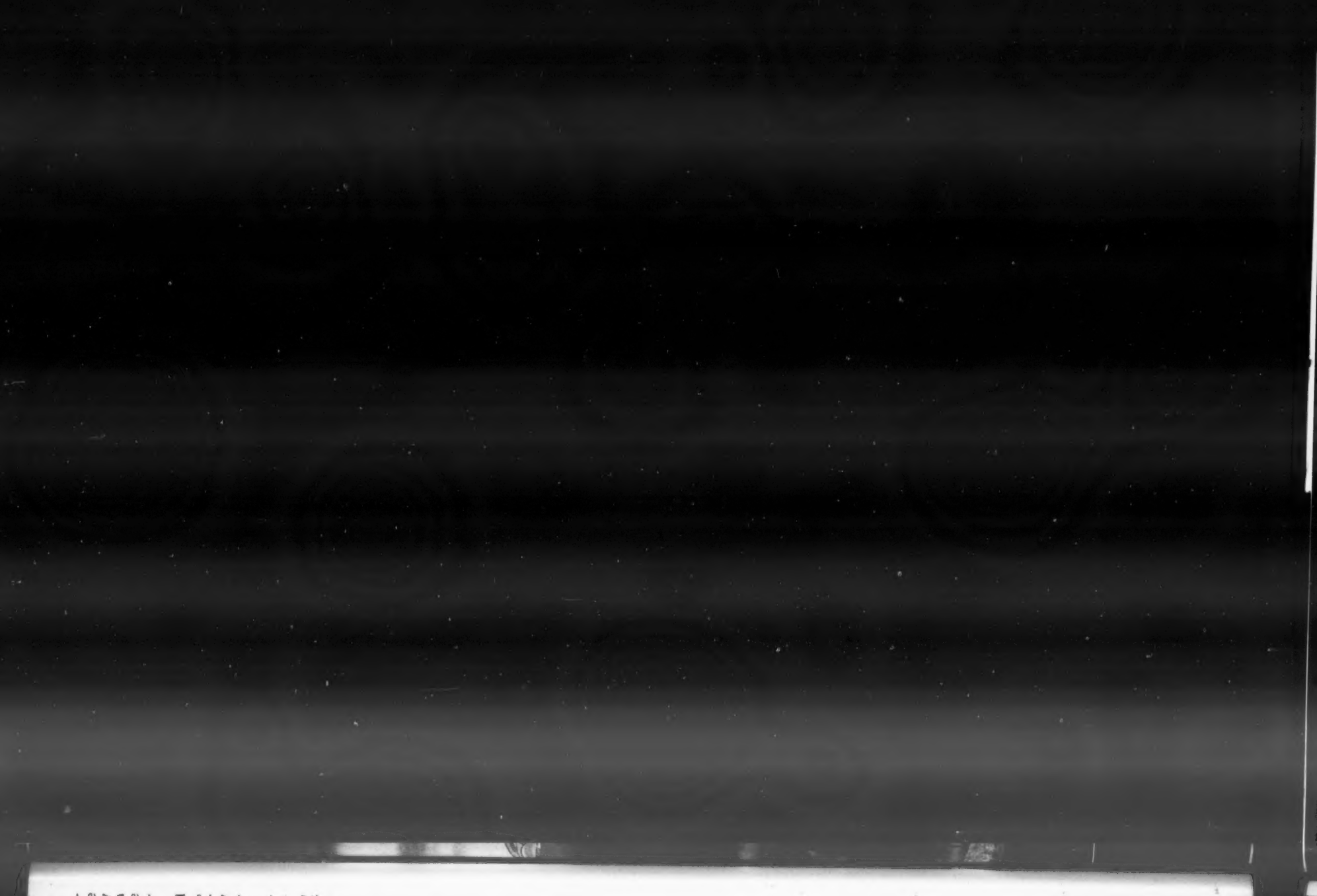
The regional subchairman will report estimates to McGowen and to Lyon F. Terry, vice president, the Chase National Bank, New York City, who is vice chairman of the committee on natural-gas reserves of the American Gas Association.

Columbia Gas Regroups Eastern Operations

NEW YORK.—By the first of the year, two of Columbia Gas and Electric Corp.'s operating groups will be combined under one management, as a further step in simplification, according to an announcement late last week from Stuart M. Crocker, president.

Top officials in the new organization will include Harry A. Wallace, Jr., now president of the Charleston group, as president, and Oliver S. Hagerman, now president of Seaboard, as vice president and general manager.

Columbia's Seaboard subsidiaries, operating pipe-line and distribution facilities through Kentucky, West Virginia, Virginia and Maryland, will become part of the system's Charleston group, which comprises production, transmission and distribution properties in West Virginia, Kentucky and Ohio.



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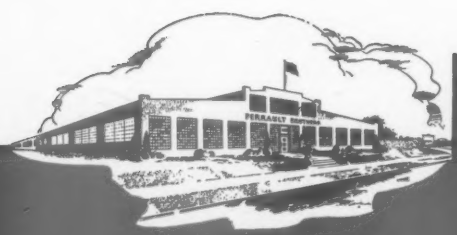

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PIPE LINES

El Paso Plans Major Project for 1946

LOS ANGELES.—At the conclusion of 4 days of hearing and taking technical data, the California Railroad Commission took under consideration the application of Southern California Gas Co. and Southern Counties Gas Co. for permission to construct 214 miles of 26-in. diameter pipe line from Blythe near the California-Arizona border to Santa Fe Springs and will render a decision early in January from the commission's San Francisco headquarters. It is likely that the Railroad Commission will grant the necessary clearance as no one presented any opposition to the petition for authority to start work not later than October 1, 1946, and to have the line in operation by the winter of 1947.

This projected gas line will connect with a 720-mile pipe line to New Mexico fields and will afford a 272-mile connection with the Hugoton gas field to be constructed by El Paso Natural Gas Co. Total costs of the 1,206-mile natural-gas line with its necessary booster stations and other facilities will approximate $50,000,000 and will have an initial capacity of 175,000,000 cu. ft. per day during the first 5 years and a maximum of 305,000,000 cu. ft. daily for the next 25 years.

The California project will require a 10,000-hp. compressor station at Blythe to handle the 175,000,000-cu. ft. initial delivery and an additional 15,000 hp. to handle maximum deliveries. Gas purchase contracts are held by El Paso Natural Gas Co. with Phillips Petroleum Co., Shell Oil Co., Inc., Gulf Oil Corp., and others and delivery will be made to facilities of Southern California Gas Co. and Southern Counties Gas Co. at approximately 250 lb.

Paul Kayser, president of El Paso Natural Gas Co., told the commission that his company had allocated $36,000,000 construction costs for its facilities, and A. F. Bridge, vice president and general manager of Southern Counties Gas Co., estimated cost of the California section at $12,140,000. Total life of the contract is 30 years, deliveries during the first years to approximate 175,000,000 cu. ft. daily and graduated upward during the last 25 years. Natural gas will be accepted at the California-Arizona border station at a cost of 15 cents per 1,000 cu. ft. initially.

There has been considerable opposition to construction of the line by California oil producers although no joint action was taken against the proposal at the time of its presentation to the California Railroad Commission. The protest of California producers is due to the fact that California gas companies hold contracts for acceptance of natural gas from oil producers at substantially below what the company will pay for gas at Blythe.

The contract between El Paso Gas Co. and the California gas companies provides that for the first 500,000,000 cu. ft. the cost will be 15 cents per 1,000 cu. ft.; for the next 500,000,000 cu. ft. the cost will be 11 cents per thousand and over 1,000,000,000 cu. ft. per month the cost will be 9½ cents. As soon as the California Railroad Commission authorizes construction and expenditures necessary, the matter will be presented to Federal Power Commission for approval. The latter agency must approve construction of the line as it will be an interstate movement of natural gas, the first time natural gas will have moved across a California boundary.

Kahle Becomes Interstate President

Loren F. Kahle was elected president of Interstate Oil Pipe Line Co. at a meeting of the board of directors December 20. Kahle has served as executive vice president of the company since its reorganization a year ago, and succeeds W. R. "Cap" Finney of New York, who remains a director of Interstate and is pipeline adviser to the parent company, Standard Oil Co. (N. J.).

Other officers reelected by the board at their meeting were: S. W. Day, Shreveport, vice president in charge of the southern division; Bruce Ramsey, vice president supervising northern division activities; P. H. Hunter, secretary; H. P. Hellinghausen, treasurer, and J. W. Cason, comptroller, all of Tulsa.

Interstate Oil Pipe Line Co. had its inception in December 1944, through the reorganization of Oklahoma Pipe Line Co., and combines the systems of Oklahoma Pipe Line Co. and the former pipe-line department of Standard Oil Co. of Loui-

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Pipe Line Equipment and Materials
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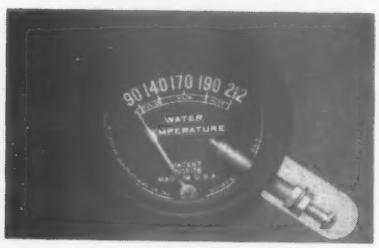

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Guardian Safety Switches prevent damage caused by failure of cooling system or oil pressure . . . save down time in repairing or replacing engines. Visible, adjustable silver contacts.

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siana. The company currently owns and operates a pipe-line system of some 2,600 miles of trunk lines and another 1,000 miles of gathering lines in Oklahoma, Arkansas, Louisiana, Mississippi, Illinois, Kentucky, Montana, and Wyoming.

Interstate Acquires Yale Oil Pipe Lines

Interstate Oil Pipe Line Co. has extended its holdings in the Northwest through acquisition of Yale Oil Pipe Lines, Inc., from The Leader Oil Co.

Joint announcement of the purchase of Yale stock from Leader was made by Loren F. Kahle, Interstate president, and O. C. Schorp, president of The Carter Oil Co., who is also president of the Yale and Leader corporations.

Kahle further announced that effective January 1, 1946, Yale will be merged with Interstate and its operations become a part of the company's northern division, managed by Bruce Ramsey, vice president.

Yale Oil Pipe Lines, Inc., organized in March 1944, operates a pipe-line system connecting the Elk Basin area in southern Montana and northern Wyoming with the Carter refinery at Billings, Mont., and the refinery of Farmers Union Central Exchange at Laurel, Mont. The system consists of approximately 51 miles of 8-in. and 29 miles of 6-in. line in all. Interstate now connects with the Yale system at Warren, Wyo., by means of a short line extending to the Frannie pool in southern Montana and northern Wyoming.

Proposals to Buy WEP Systems

The Surplus Property Administration has disclosed several groups are seeking to acquire the systems of War Emergency Pipelines, Inc.

Purchase propositions are under consideration by a special Senate petroleum committee headed by Senator O'Mahoney of Wyoming.

Both natural gas and oil interests have discussed plans to take over the $145,800,000 WEP lines.

One group of prospective purchasers is represented by Oscar S. Cox, former assistant solicitor general.

Cox, whose group proposes to take over the lines for natural gas deliveries, declared:

"There are three alternatives. The pipe lines can be scrapped, kept on a standby basis for use in the event of another war, or made available to produce the best revenue possible, which would be through natural gas deliveries.

"Our position is that should the lines be used for natural gas the Government would receive a substantial capital payment and natural gas would be available 25 per cent cheaper than through existing facilities."

The committee's report is expected to be completed shortly after the next session of Congress opens.

No action can be taken on the purchase proposals until Congress has had the report for 30 days.

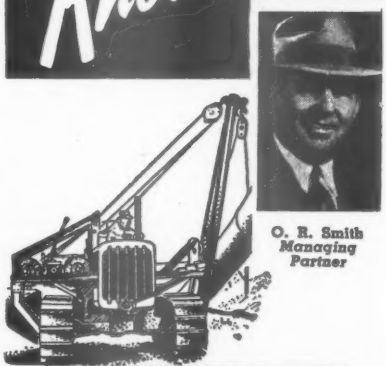
Railroad and coal mining interests, both labor and management, are strongly opposed to allowing the lines to be used by natural gas producers.

United Operates Carthage Outlet

United Gas Pipe Line Co. has placed in operation its 142-mile 24-in. gas pipe line from the Carthage gas area of Panola County, Texas, to Sterlington, La., at a cost of approximately $7,500,000. United announced its entire project in the Carthage area, including gasoline and dehydration plants, should be completed early in 1946.

The company will furnish gas to Tennessee Gas & Transmission Co., through a connection with the latter's line at Sterlington.

PIPELINE "Know-how"



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MAIN BUSINESS OFFICE
FORT WORTH NATIONAL BANK BLDG.
FORT WORTH 2, TEXAS

COMPANY adds
evaporation-saving equipment

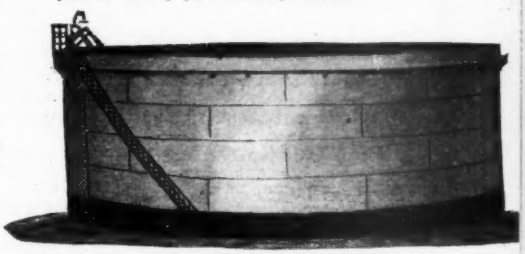
The technical processes utilized in today's refining and blending operations require the extensive use of various types of evaporation - saving equipment. The Horton Floating Roof, illustrated and described on the opposite page, incorporates several outstanding features of design and construction which makes it particularly effective in preventing evaporation and reducing fire hazard from volatile products stored in flat-bottom storage tanks. This floating roof and the other types of roofs and pressure storage tanks shown here embody the engineering experience and skill acquired during twenty - two years of designing, fabricating and erecting evaporation-saving equipment for the petroleum industry. Each product is designed for a particular type of service.

We invite you to write our nearest office for further information on any of these products.

*CHICAGO BRIDGE & IRON COMPANY TRADE MARK

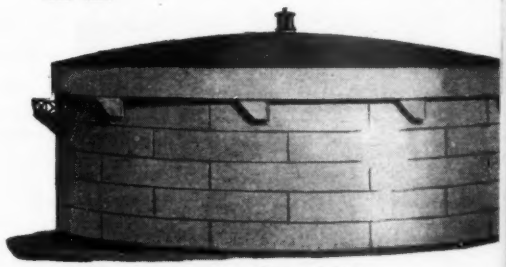
WIGGINS BREATHER* ROOFS

. . . are used to reduce breathing losses on standing storage tanks. They are particularly recommended for tanks 60 ft. in diameter or larger that are kept full or nearly full most of the time.



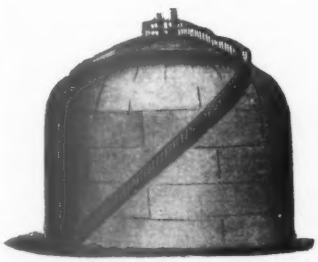
WIGGINS* FLOATING ROOFS

. . . are supplied for installations where the volatility of the oil does not require the insulating qualities of the Horton roof. These roofs, in varying specific forms, have been used extensively on tanks storing sour crude oil and will hereafter be available in forms particularly well adapted for this use.



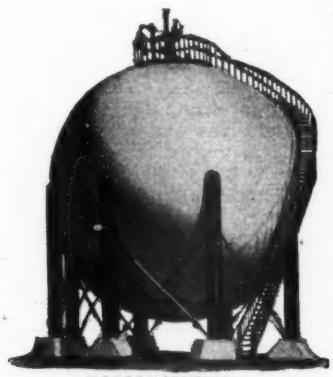
HORTON LIFTER ROOFS

. . . reduce evaporation losses from standing storage or slow working tanks. The vapor spaces of several adjoining cone roof tanks are often connected to the vapor space of a tank with a lifter roof. When this is done the lifter roof serves as a central storage unit for all of the tanks.



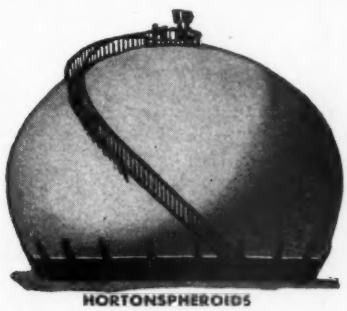
HEMISPHEROIDS

. . . provide an economical means of storing liquids requiring pressures of only 2½ to 5 lbs. per sq. in. to stop standing storage losses under normal operating conditions. Built in sizes from 2,000 to 7,500 for 2½ to 5 lbs. per sq. in. pressure and from 10,000 to 30,000 bbls. for 2½ lbs. per sq. in. pressure.



HORTONSPHERES

. . . are used for storing highly volatile liquids and gases. They prevent evaporation by allowing pressure to build up inside the tank instead of venting. Available in standard capacities from 1,000 to 30,000 bbls. for liquids and from 20 to 65 ft. in diam. for gases.



HORTONSPHEROIDS

. . . are large capacity pressure tanks for storing hydrocarbons ranging in volatility from motor fuel to natural gasoline. Smooth Hortonspheroids are built in capacities of 2,500 to 40,000 bbls. for pressures from 2½ to 35 lbs. per sq. in. and noded designs from 20,000 to 120,000 bbls. for 2½ to 20 lbs.

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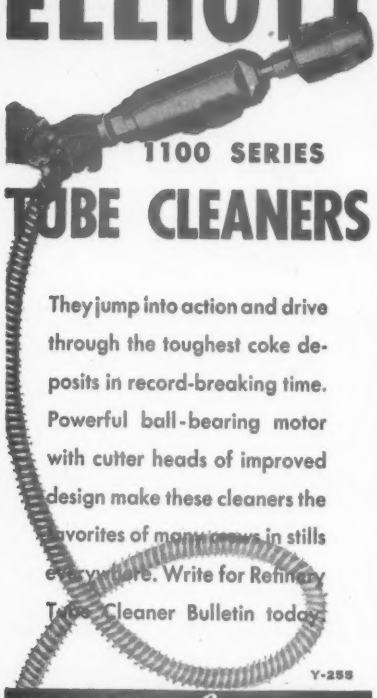

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TUBE CLEANERS

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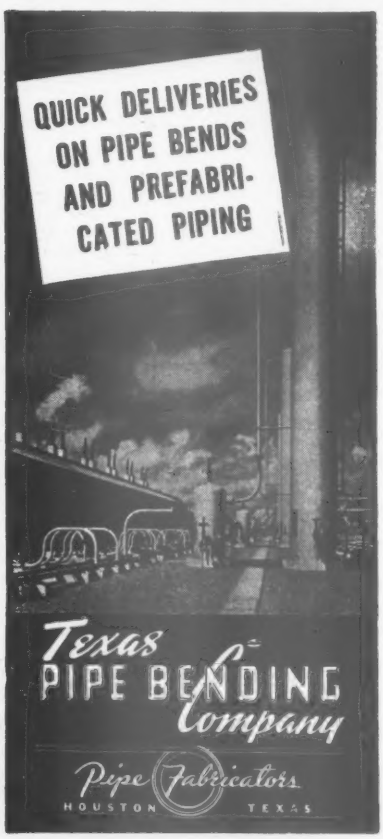

REFINING

Small Catalytic Plants Will Be Discussed

The first postwar regional technical meeting of the Western Petroleum Refiners Association will be held at El Dorado, Ark., January 18, at the Garrett Hotel. The meeting will start at 4 p.m.

The topic for discussion will be "Catalytic Cracking for Medium and Small Refiners," and will be presented by The Universal Oil Products Co. of Chicago. In this discussion, various types of catalysts, product yields, and actual operating costs will be presented in detail. Following this presentation, open discussion will be held on the paper presented.

A.P.I. Asks Extension of Date on Carrier Order

WASHINGTON.—A one-year extension of the order to place private carriers under current regulations governing transportation of inflammable liquids by common and contract carriers was requested last week by the American Petroleum Institute in a letter to the Interstate Commerce Commission.

As far as the petroleum industry is concerned, this order would mainly affect gasoline transportation. Many industry sources state that it is not properly applicable to private carriers in many requirements.

When the ICC first issued the order May 12, 1943, extending regulations "governing the transportation of explosives and other dangerous articles," the A.P.I. presented evidence to show the impossibility of compliance at that time. The ICC postponed the effective date until January 1, 1944. Subsequently, other postponements were made.

It is pointed out that although the postponed ICC order was "quite properly" designed to protect common and contract carriers who might otherwise be ignorant of the dangerous nature of the shipment, such precautions are unnecessary when applied to the shipment of these liquids by the oil industry itself.

In a letter, dated December 17, 1945, to W. P. Bartel, ICC secretary, D. V. Stroop, newly-appointed assistant to the A.P.I. president, stated: "As sufficient time has not elapsed to conclude a full measure of understanding on the amendments proposed under your notice of October 12, 1944, and as abnormal wartime conditions restricting availability of men, materials, parts, and automotive equipment have continued and will continue after December 31, 1945, we request the commission to extend the effective date of its order No. 3666, MC 13, and MC 3 dated December 31, 1943 until December 31, 1946, or until further order of the commission."

Texas Plans $6,000,000 Expansion at Casper

NEW YORK.—An expansion program involving expenditure of about $6,000,000 at its refinery in Casper, Wyo., by The Texas Co. is announced by W. S. Rodgers, president.

The principal improvement will be a new fluid catalytic-cracking and gas-recovery unit that will cost in the neighborhood of $4,500,000. The general purpose of this unit is to place the company in a position to supply high-octane gasoline from the Casper works. Heretofore, it has been necessary to ship the components of this type of gasoline from other refineries to Casper.

Other improvements include a new crude still and vacuum unit that will provide products from crude. The existing thermal-cracking equipment is to be increased in capacity and modernized to permit the manufacture of high-quality products. The company also will install facilities for the manufacture of road oil and asphalt products to supply the demand in the Casper area. Work is expected to get under way next spring and be completed by the end of the year.

OPA Raises Fuel Ceilings To Avert Shortages

WASHINGTON. — Office of Price Administration has ordered immediate price increases for kerosene and heating oils in two areas, with a view of averting threatened shortages of these products in the East.

The increase, which will continue in effect through April 30, are ½ cent a gallon for kerosene, range oil and No. 1 fuel oil, and 0.2 cent a gallon for Nos. 2, 3 and 4 fuel oils. In states along the Atlantic seaboard, the increases apply, with two exceptions, at all distribution levels, including sales to consumers.

In the Gulf Coast area, the price advances apply only to sales by refiners and tanker terminals for shipment to the East Coast area. The increases are ordered in the Gulf Coast area because it is a major source of supply for the East. The increases had been recommended by the industry to provide an incentive to refiners to make more kerosene and heating oil and less gasoline.

The Gulf Coast area, which comprises District 3, is made up of New Mexico, Texas, Arkansas, Louisiana, Mississippi, Alabama and Florida west of the Apalachicola River.

In the East Coast area, known as District 1, the increases do not apply on sales to or within the Schedule D portion of the district which is made up of most of West Virginia and western parts of New York and Pennsylvania. OPA said there was no apparent shortage of kerosene and heating oils in those areas. Neither do the increases apply on sales for export or on sales to exporters.

District 1 includes the New England states and New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, West Virginia, the District of Columbia, and Florida east of the Apalachicola River.

Kendall Adds Two More To Board of Directors

BRADFORD, Pa.—Two new members were added to the board of directors of Kendall Refining Co. at the annual meeting of stockholders held at the company's offices here. The new members are Russell A. Keck, general manager of sales, and Howard V. Smith, refinery superintendent. Other board members, all reelected, are Otto Koch, J. B. Fisher, S. J. Brill, Joseph H. Bovaird, D. W. Daly, Louis E. Koch, Paul C. Duke, Fred D. Gallup, Don T. Andrus and A. E. Both.

The new directors reelected the following officers for the ensuing year: Otto Koch, chairman of board and treasurer; Fisher, president; Bovaird and Andrus, vice presidents; Brill, secretary; H. W. Jackson, assistant secretary and assistant treasurer.

Like Brand-Name Gasoline Best, Survey Indicates

NEW YORK.—A vast majority of American motorists like brand-name gasoline best, a survey just completed for Brand Names Research Foundation indicates. Among men interviewed in 10 cities, 88.1 per cent said they preferred branded motor fuel.

"The studies indicate that brand names are accepted guides to the characteristics and quality desired in gasoline," Henry E. Abt, managing director of the foundation, said. "They reflect the success attendant upon continued service and constructive education on the nature and value of brand names."

Cities in the survey were New York; Elmira, N. Y.; St. Louis; Boston; Roanoke, Va.; Savannah, Ga.; Burlington, Vt.; Chicago; Columbus, Ohio, and Dallas.

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Oil Producers

Transporters

Avoid costly shutdowns and repairs to engines due to overheating often caused by dirty or partially plugged cooling systems, by simply adding **EASY CLEAN** SOLVENTS to your present cooling water.

Guaranteed NON-INJURIOUS to rubber or metals, and to REMOVE accumulated scale and rust, **EASY CLEAN** will restore efficiency of your engine cooling system — regardless of size.

EASY CLEAN water treating service is backed by nearly 28 years of experience— Pumping Engines, Drilling Engines, Boilers, Cooling Towers, Spray Ponds, etc

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LELAND HAMNER CO.

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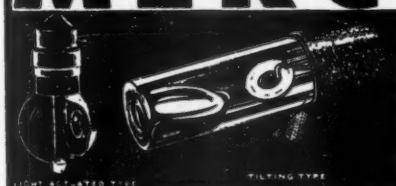


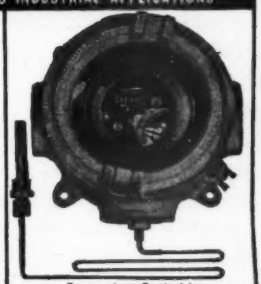
The Only 100% Mercury Switch Equipped Controls

FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

If you have a pressure or temperature control problem Mercoid engineers will assist you.

See catalog No. 600 for complete information on all types of Mercoid Controls.

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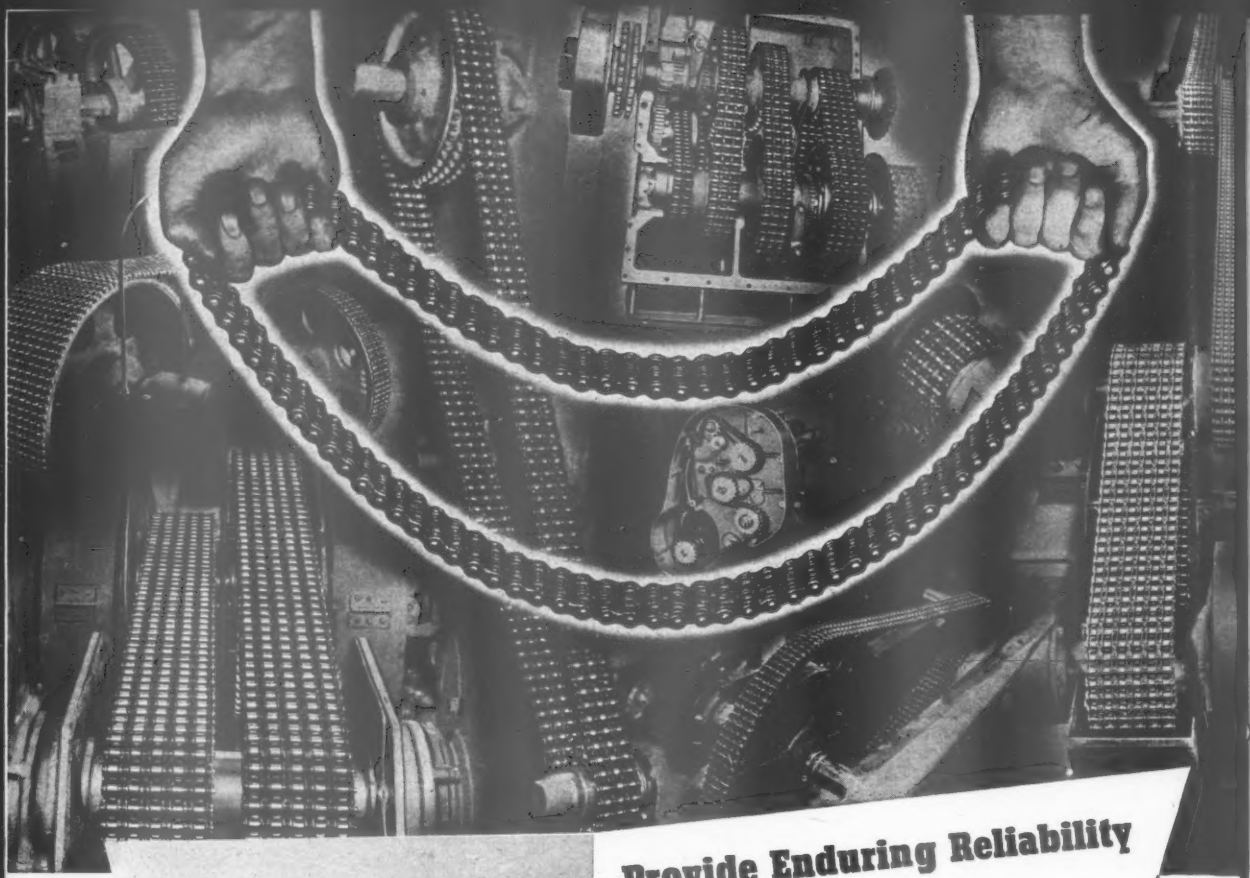
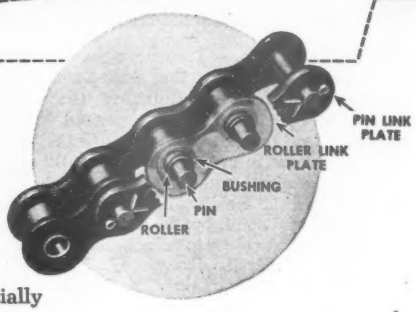


Drives Like These Provide Enduring Reliability



Oil Field Machinery Leaders Use Diamond Chains

The smoothness of action and long-retained, high mechanical efficiency of Diamond Roller Chain Drives are functions of their uniformity, accuracy, and high quality.

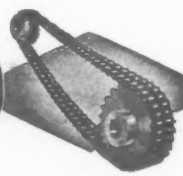
The "bearings" of roller chains—pins, bushings and rollers—are of alloy steel, case-hardened, and finely finished. The folding and rolling meshing of roller chains and sprockets, and load distribution among the many teeth in mesh contribute to the efficient performance for which Diamond Drives have long been noted.

After many years of service, the efficiency of roller chain is substantially the same as that of brand new chain. The finish of all working surfaces improves, and with scarcely measurable wear until years have elapsed. The strength of roller chain drives decreases very slightly with use. Machine bearings are subjected to no excess loading from separating force as with gears, nor from initial tension as with belts.

Diamond Positive Drives assure steady production rate, and low initial, operating and maintenance costs.

From the time 25 years ago when radical modernization of mechanical drilling, pumping and servicing equipment began, DIAMOND Roller Chain Drives have been important factors in the continuing improvements made by America's leading rig builders. . . . Their field performance during all these years has justified their wide usage.

Diamond Roller Chains on the rig you buy give added insurance of low-cost, long-life operation. DIAMOND CHAIN & MFG. CO., 475 Kentucky Avenue, Indianapolis 7, Indiana. Tulsa Office: 2238 Terwilleger Blvd.

DIAMOND  **ROLLER CHAINS**

Exploration and Drilling

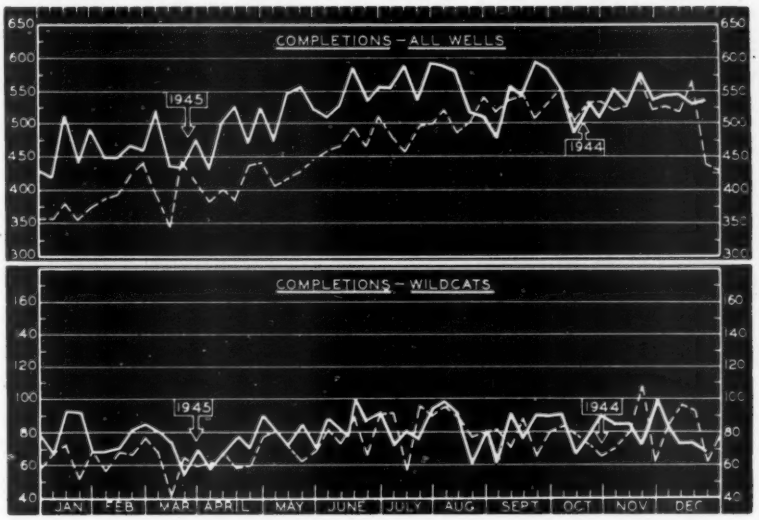
Week's Highlights

THE year ends on a more optimistic note than it began as far as the wildcatters and geologists are concerned. When the year began there was some doubt about whether proven reserves had held their own during 1944 in the face of high war demands for crude combined with shortages of manpower and material. But the general feeling was that even if the 1944 hurdle had been cleared, the forecasts of military demands during 1945 indicated still higher hurdles.

Shortly after the beginning of 1945 it became apparent that proven reserves had held their own during the previous year, but that the military demands would call for another year of all out effort, with only a slight easing of the material and manpower setup. With the end of the war, the 1945 hurdle was abruptly lowered in height, and for a time there was worry about a temporary low during reconversion. Unexpectedly high peacetime demands during the reconversion period have eased the transition.

Now the geologists and wildcatters can afford to relax long enough to worry only about the prospects of finding enough oil to meet the future demands of an expanding economy. Not that this is an easy problem. Many executive geologists, figuring their companies' relative competitive position at present, and the amount of new oil that must be found to maintain that position in an expanding economy do considerable worrying.

However, having faced and overcome the problems of the biggest



Solid line charts current weekly completions—service wells included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 22, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	26	14	0	*12	47,153	1,442	1,547	0	0	0	0	0	0	0	0	0	0
Pennsylvania	74	31	5	†38	121,397	3,941	4,042	0	0	0	0	0	0	0	0	0	0
West Virginia	12	2	7	3	33,077	789	870	0	0	0	0	0	0	0	0	0	0
Ohio	6	2	2	2	12,056	964	1,002	0	0	0	0	0	0	0	15	62	77
Indiana	4	2	0	2	7,032	193	246	0	0	0	0	0	7	0	0	25	32
Kentucky	14	9	1	4	26,786	566	746	0	0	0	1	1	23	0	4	53	80
Illinois	43	28	0	15	106,339	1,782	1,950	0	0	0	6	6	51	0	0	306	357
Michigan	15	5	4	6	31,831	749	671	0	0	0	3	3	11	0	7	278	296
Kansas	42	19	7	16	135,278	1,746	1,804	1	0	1	3	5	36	0	16	328	380
Neb., Mo., Iowa	0	0	0	0	0	29	41	0	0	0	0	0	0	0	0	18	18
Oklahoma	52	32	4	16	185,380	2,364	1,826	2	0	0	5	7	81	3	18	351	453
Texas	156	93	14	49	673,251	7,057	5,588	6	0	0	24	30	206	16	54	1,259	1,535
North Central	64	34	1	‡29	167,749	2,192	1,476	1	0	0	12	13	73	0	5	451	529
West	34	30	0	4	165,689	1,698	1,572	1	0	0	1	2	54	1	0	241	296
Panhandle	7	2	5	0	20,362	525	304	0	0	0	0	0	0	0	1	7	8
Eastern	9	4	4	1	52,063	386	316	0	0	0	1	1	6	8	2	86	100
Gulf Coast	37	23	3	11	242,936	1,631	1,262	4	0	0	7	11	58	6	35	293	392
Southwest	5	0	1	4	24,452	502	658	0	0	0	3	3	15	1	11	181	208
Louisiana	24	11	3	10	160,625	1,084	798	1	0	1	5	7	33	4	7	124	168
Northern	15	4	3	8	69,811	479	320	0	0	1	4	5	8	1	7	74	90
Southern	9	7	0	2	90,814	605	478	1	0	0	1	2	25	3	0	50	78
Arkansas	3	1	0	2	17,000	180	215	0	0	0	0	0	2	0	0	40	42
Mississippi	4	3	0	1	23,138	351	158	0	0	0	1	1	6	0	0	116	122
Southeastern States	1	0	0	1	5,776	58	52	0	0	0	1	1	1	0	1	38	40
Montana	9	7	1	1	18,127	309	349	0	0	0	0	0	10	0	0	24	34
Wyoming	4	3	1	0	15,053	223	184	0	0	0	0	0	18	0	1	44	63
Colorado	3	0	0	3	12,552	58	36	0	0	0	3	3	1	0	1	16	18
Utah	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1
New Mexico	18	13	0	5	63,347	416	397	1	0	0	0	1	12	0	6	62	80
California	28	23	0	5	132,325	2,155	1,969	0	0	0	2	2	4	0	2	225	231
Total United States	538	298	49	191	1,827,523	26,457	24,491	11	0	2	54	67	502	23	133	3,369	4,027
Total previous week	529	280	54	195	1,754,138	25,919	24,044	4	0	1	68	73	491	23	131	3,315	3,960
Total Dec. 23, 1944	457	262	34	161	1,486,453	24,491	17,754	12	0	2	47	61	456	26	124	3,195	3,801

Service wells included: *12, †36, ‡2.

war in history, both the geologists and the wildcatters actually have plenty of confidence in their ability to find plenty of new fields, when and as they are needed. There are several areas of potential greatness, in which intensive exploration work will undoubtedly develop much larger production than exists today.

Among these are the coastal province from Louisiana to the tip of Florida; the pre-Permian in West Texas; the Anadarko basin in Oklahoma, and the Rocky Mountain region. In addition there is the coastal shelf, where the normal dips and thickening of potential producing formations add many more cubic miles of potential oil-bearing sediments for each horizontal mile on the surface, than exists on the adjacent mainland.

MISSISSIPPI

Adams County Test Cores Oil in Massive

JACKSON.—Roeser & Pendleton and Sohio Petroleum 1 Baker-Maier, 34-6n-2w, in Adams County, has cored gas-condensate and oil in the Massive sand. Coring was begun at 10,533 ft., and first saturation by core analysis was found at 10,549 ft. Production tests will be run on the Massive sand zone, and additional sidewall cores may be taken in the Wilcox sand at 6,213-6,247 ft., where shows of oil were encountered.

The Gilbertown field of Choctaw County, Alabama, is receiving another producer in the Carter Oil Co. 1 Johnson unit, SW SE NW 4-10n-3w. Plugging back to 3,300 ft. in the Eutaw, operators swabbed oil and mud and later pumped 96 bbl. of 20.4-gravity oil with 1 per cent basic sediment and water.

Only one new location has been announced, a test for the Flora field of Madison County, Mississippi. Completions totaled four, including three oilers in proven areas and one dry wildcat.

MISSISSIPPI WILDCAT FAILURE

Smith County: Hunt Oil 3 Smith County Oil Co., SW SW SW 4-2n-8e, dry, TD 7,647 ft., Comanche 7,645 ft.

ALABAMA WILDCAT FAILURE

Wilcox County: Seaboard Oil 1 McConnico, 467 ft. north and 467 ft. east of SW corner of NW 32-12n-10e, dry, TD 5,776 ft., Igneous 5,520 ft.

SOUTH LOUISIANA

Jefferson Davis Parish Gets New Oil Field

NEW ORLEANS.—A new oil field has been opened by Sohio Petroleum Co. at their Claudius Fontenot et al Iowa Junction, 15-10s-6w, in Jefferson Davis Parish. Drilled to a depth of 11,000 ft. before plugging back to 9,750 ft. this test flowed at the rate of 6 bbl. of 37-gravity oil hourly through ⅛-in. choke, through perforations at 9,694-9,703 ft. Gas-oil ratio was 500 to 1, tubing pressure 1,350 lb.

Shell Oil Co., Inc., brought in a new sand at Napoleonville, in Assumption Parish when their 1 C. L. Triche, 33-12s-13e, gaged 245 bbl. of 34-gravity oil daily through an 8/64-in. choke with 1,825 lb. pressure on the tubing and 1,500 lb. casing pressure. Production is from a new sand for the field area encountered at 9,430-78 ft. Total depth is 9,763 ft., with 5½-in. casing on bottom, and perforations at 9,462-67 ft.

Tide Water Associated Oil Co. 28 Buras Levee district, 23-21s-30e, at Venice, in Plaquemines Parish, on an initial test made through the drill stem, lasting 8 hours, flowed at the rate of 178 bbl. of oil daily with 1,800 lb. pressure, using ¼-in. and ⅛-in. chokes, through perforations at 11,536-38 ft. Operators then made additional perforations at 11,538-45 ft., ran the tubing, and test is cleaning into the pits with no water in evidence. Total depth is 11,716 ft. and 5½-in. casing is set at 11,711 ft.

In the Mamou area, Evangeline Parish, Magnolia Petroleum Co. 1 J. B. Morein, wildcat, 5-5s-1e, is preparing to test oil sand encountered in the Wilcox which was topped at 11,510 ft. This test is credited with numerous shows in the Sparta, and sand in the Cockfield is reported to show gas and condensate.

Amerada Petroleum Corp. 1 Lake Superior Piling Co., wildcat Wilcox test in 11-4s-9e, Tangipahoa Parish, has been plugged as a dry hole after an electrical log was run to 9,821 ft., total depth. Top of Wilcox was at 6,413 ft. No shows were reported.

There were 10 new locations reported this week with only 1 wildcat in Iberia Parish. Of the nine completions, seven are oil and two dry, with two wildcats, one a new sand in Assumption Parish, and one dry hole in Tangipahoa Parish. Acadia Parish received the greatest number of completions, with three producers reported for Egan field.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Assumption Parish: New oil sand, Napoleonville—Shell 1 Triche, 33-12s-13e, TD 9,763 ft., perf. 9,462-67 ft., PT 245 bbl. 24 hours through 8/64-in. choke, gas-oil ratio 890, TP 1,825 lb., CP 1,500 lb., gravity 34°, no water.

SOUTH LOUISIANA WILDCAT FAILURE

Tangipahoa Parish: Amerada 1 Lake Superior Piling Co., 11-4s-9e, dry, TD 9,821 ft.

EASTERN TEXAS

Cavings Shut Off Oil In Leon County Wildcat

DALLAS.—Claude Bell 1 Browne-Carson, Thomas H. Garner Survey, wildcat 3 miles southeast of Flynn, Leon County, perforated liner set on bottom and pumped an estimated 10 to 15 bbl. of clean oil the first day. The next day it decreased to 2 bbl. of oil per day. It was thought that cavings shut off the oil. Operator will bail and clean out cavings. Total depth is 7,303 ft. and elevation 415 ft. Delta Drilling Co. 1 Livingston, Nacogdoches University Survey, Travis Peak wildcat 3 miles southeast of Reilly Springs in southern Hopkins County, was drilling below 8,270 ft. in hard sand.

Humble Oil & Refining Co. 1 Pickering Francois Survey, in the Huxley area of eastern Shelby County, was drilling below 11,445 ft. This is the deepest drilling wildcat at present in the East Texas area. Magnolia Petroleum Co. 1 Orr, Fowler Survey, northwestern Marion County wildcat southwest of Avenger, was drilling below 7,200 ft. The anhydrite zone was topped at 6,717 ft., and elevation is 439 ft. Humble 1 Lutz, Allison Survey, in the west Jackson area of Van Zandt County, another Travis Peak wildcat, was drilling below 7,545 ft. in lime and shale.

Hawkins field, Wood County, and Carthage field, Panola County, each had three completions this week. Hawkins field reported 11 new locations and Carthage field 6.

EASTERN TEXAS WILDCAT FAILURE

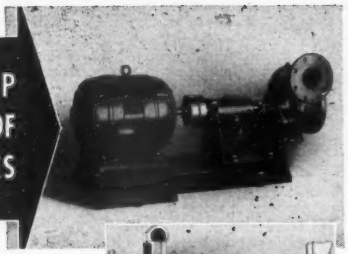
Hunt County: Paul B. Scott & Grey 1 Irwin, Mary Keys Sur., 1 mi. N Quinlan, elev. 479 ft., Paluxy 4,354 ft., dry, TD 4,373 ft.

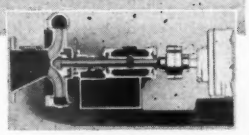
DAILY AVERAGE PRODUCTION FOR WEEK

	Dec. 22 crude oil	Bureau of Mines demand forecast	State allowable	Dec. 15 crude oil
Alabama	150	400	.....	150
Arkansas	75,850	83,273	78,397	75,900
California	835,350	850,000	824,000	846,950
Colorado	19,150	20,000	.....	19,700
Eastern	60,800	65,200	.....	58,900
Florida	100	100	.....	100
Illinois	209,300	213,000	.....	208,800
Indiana	12,900	13,500	.....	12,950
Kansas	260,750	268,000	255,000	264,850
Kentucky	28,700	29,000	.....	28,750
Louisiana	371,400	365,000	406,135	371,450
North Louisiana	76,100	.....	.....	76,150
South Louisiana	295,300	.....	.....	295,300
Michigan	44,700	47,000	.....	48,900
Mississippi	52,100	48,000	.....	53,600
Montana	22,950	22,000	.....	22,950
Nebraska	750	800	.....	750
New Mexico	101,900	102,000	104,000	102,000
Oklahoma	387,250	388,000	388,000	387,500
Texas	1,918,900	1,940,000	1,938,369	1,918,900
East Texas	307,000	.....	.....	307,000
East Central Texas	130,300	.....	.....	130,300
North Central Texas	149,650	.....	.....	149,650
Texas Panhandle	81,000	.....	.....	81,000
West Texas	465,800	.....	.....	465,800
Southwest Texas	314,550	.....	.....	314,550
Texas Gulf Coast	470,600	.....	.....	470,600
Wyoming	85,100	92,000	.....	85,600
Total United States	4,488,100	4,542,000	.....	4,508,700
Change from prev. week, down	20,600			

Total production January 1-December 22, 1945 ..... 1,664,054,925 bbl.
Same period last year ..... 1,630,405,660 bbl.

HERE IS A PUMP FOR A VARIETY OF INDUSTRIAL USES





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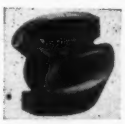
Above: Goulds "Flexi-Unit" centrifugals are readily accessible for maintenance. Removal of suction cover permits impeller adjustment. Impeller bolted to shaft flange for quick dismantling. Shaft is supported by two heavy-duty ball bearings. Stuffing box is extra deep for ample packing. Special sealing arrangements for handling liquids containing foreign matter.



Special warped vane impeller with round nose.

Of the various types of centrifugal pumps Goulds manufactures, the "Flexi-Unit" is used for a greater variety of services than most. Sturdily built, they range in size from 1" to 4" and in capacities from 10 to 1000 G.P.M. They will handle heads up to 280 ft. Various constructions and refinements further increase their adaptability. Note the special features below.

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KANSAS

South Ryan Field Gets Second Producer

THE newly discovered South Ryan field of Pawnee County is getting its second producer this week in Magnolia Petroleum Co. 1 Erickson, SW SW SW 1-20-16w. The well flowed at the rate of 3 bbl. of oil per hour from the Arbuckle at total depth of 3,739 ft. Operators are planning to drill a few feet deeper and acidize. The discovery well, Hildebrande et al 1 Wickstrom, NW NW NW 12-20-16w, picked the Arbuckle top 3 ft. higher than the second well.

Stanolind Oil & Gas Co. 1 Mousloff-B, NW NW NE 25-19-16w, 2 miles northeast of the Ryan pool, flowed 3 bbl. of oil per hour, and is planning to acidize. Arbuckle was found at 3,645-3,754 ft. Pipe was set and perforations were made at 3,713-17 ft.

In Phillips County, Helmerich & Payne et al 1 Bowman "A," NW NW SE 3-5-20w, is drilling ahead at 3,113 ft. after logging porosity and stain at 3,085 ft. and 3,100-04 ft. Nearest production to this test is the Hansen pool, 2 miles south.

Forty-two completions for the week included 19 oil wells, 7 gas wells, and 16 dry holes. One new oil field and one new gas field were opened in Russell and Barber counties, respectively, and three dry wildcats were finaled.

KANSAS SUCCESSFUL WILDCATS

Barber County: New gas pool—Skelly 1 Boggs, NW NW NE 8-33-12w, gaged 5,094,000 cu. ft. gas from Mississippi lime at 4,472-4,593 ft., TD 4,593 ft., Kansas City 3,960 ft., Mississippi 4,471 ft.

Russell County: Coralena 1 Olson, CSL SE SE 23-13-15w, potential 29 bbl. from Kansas City at 3,267-78 ft., TD 3,336 ft., Topeka 2,778 ft., Kansas City 3,048 ft., Arbuckle 3,324 ft.

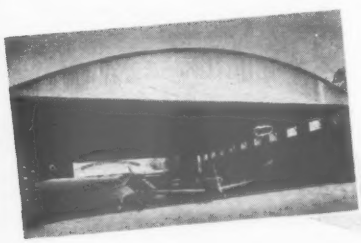
KANSAS WILDCAT FAILURES

Ellis County: Fred Anschultz 1 Hoff, SE SE SE 18-12-16w, dry, TD 3,691 ft., Arbuckle 3,655 ft.

Marion County: Veeder Supply 1 Lietz, NE SW SW 6-18-5e, dry, TD 2,304 ft., Mississippi chat 2,262 ft.

Sumner County: Ed Adair and Kanotex 1 Gardner, NE NE SW 3-33-2e, dry, TD 3,537 ft., Arbuckle 3,512 ft.

Performance



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SOUTHWEST TEXAS

Atascosa County Wildcat Making Production Test

CORPUS CHRISTI.—In Atascosa County, ¾ mile southwest of Jourdanton, Humble Oil & Refining Co. 1 Henry Schorsch, wildcat, is swabbing in for a production test through perforations at 7,387-90 ft. Drilled to total depth of 7,405 ft., with casing on bottom, this test previously recovered salt water and oil through perforations at 7,387-90 ft. and a squeeze job was made.

The Harrus Syndicate 2 M. M. Garcia, second test in the recently opened Parsons area of Starr County, has been completed for 108 bbl. per day through a ⅛-in. choke, through perforations at 3,440-60 ft. Tubing pressure is 380 lb., casing pressure 380 lb., gravity 41°, no water. Total depth is 3,589 ft. with 5½-in. casing set to 3,565 ft. Two new tests have been staked by this operator in this field, their 4 and 5 Garcia in Porcion 90, Block 13.

Shell Oil Co., Inc. 1 William Van Hoogenhuyze, wildcat, Lot 6, Block 10, Burton & Danforth Subdivision of Parrita Ranch, 1½ miles southeast of the Wilson field in Jim Wells County, perforated pipe at 9,040-49 ft. and flowed gas and condensate through ¼-in. choke with tubing pressure 2,000 lb. Total depth of this hole is 9,060 ft. with 7⅝-in. casing set to bottom. Casing had been set to bottom after controlling a blow which developed at bottom. This test was made in the zone which blew out.

There were 42 new locations reported this week, 3 being wildcats, 1 in Goliad County and 2 in Bee County. Willacy County received seven new locations to take the lead this week, with Duval next with five. The 23 completions include 6 wildcats, 1 oil discovery in Kleberg County, 5 dry holes, 1 each in Duval, Karnes, Kerr, Live Oak, and Webb counties. Jim Wells and Willacy counties received the greatest activity with four completions

SOUTHWEST TEXAS SUCCESSFUL WILDCAT

Kleberg County: New oil pool, Monte Negra—Humble 1 King Ranch-Monte Negra, Santa Gertrude Grant, 4 mi. SW of Kingsville, TD 7,763 ft., perf. 7,065-73 ft., PT 168 bbl. per day through ⅛-in. choke, gas-oil ratio 645, TP 1,025 lb., gravity 35°, 0.2 per cent water.

SOUTHWEST TEXAS WILDCAT FAILURES

Duval County: Argo Oil 1-C John E. Murphy, BS&F Sur. 112, 5 mi. NE of Seven Sisters, dry, TD 8,007 ft.

Karnes County: Federal Royalty and Rio Grande Drilling 1 Mrs. Mary Yanta, John Pickett Sur. 227, 3 mi. N of Helena, dry, TD 7,280 ft.

Kerr County: Ohio Oil 1 Charles O. Robinson, TWNG Sur. 47, Abst. 454, dry, TD 5,070 ft.

Live Oak County: Newman Brothers Drilling and Rowan & Hope 1 Fritz Meyer, M. G. Frazier Sur., 5 mi. NE of Mathis, dry, TD 4,770 ft.

Webb County: John F. Camp 2 Marrs McLean, Block 17, James Subd. of Garcia Tract, Albercas Grant, 2½ mi. NE of Albercas field, dry, TD 2,706 ft.

TEXAS GULF COAST

New Oil Sand Opened For Hitchcock Field

HOUSTON.—A new oil sand for Hitchcock field, Galveston County, has been opened by Stewarts 16 fee, in Jas. Spillman Survey. Through 12 perforations at 6,523-26 ft. the well flowed 162 bbl. daily through a ⅛-in. choke with 910 lb. tubing pressure, casing on seal. Gas-oil ratio is 387 to 1, and gravity of oil 33°, no water. Total depth is 6,897 ft., with top of sand at 6,521 ft. The 5½-in. casing was set at 6,804 ft. Regular field sand is encountered between 5,100 and 5,200 ft. levels. This is the second sand to produce for the field. A north outpost test, 19 fee, is being rigged up.

A new sand for Boling field, Wharton County, was opened when Danciger Oil & Refining Co. 3 A. A. Mullins flowed 250 bbl. daily through a 12/64-in. choke with 240 lb. pressure on the tubing and 490 lb. on the casing. Gas-oil ratio is 265 to 1. This is a workover well. Old perforations at 2,524-34 ft. were squeezed, and cement was drilled out to 2,623 ft., and perforated with 36 shots at 2,614-20 ft., and well was recompleted in new sand for the field. Old total depth was 2,763 ft.

In the Blue Lake extension area, Brazoria County, Glenn H. McCarthy has completed his 1 Thomas W. Masterson, in the George Robinson Survey, Abstract 126. This well completion will be known as the 1 "T" since the well may be dual-completed. On production test this well gaged 207 bbl. of 33-gravity oil daily, through a 9/64-in. choke with 1,475 lb. pressure on tubing, and a gas-oil ratio of 913 to 1, 0.1 per cent water. Total depth is 10,549 ft., with 5½-in. casing set at 9,227 ft., and perforated with 24 holes at 8,932-38 ft.

John W. Mecom 2 Cade et al, on the west flank of the High Island dome, Galveston County, W. M. Hudson Survey, on potential test gaged 896 bbl. of 27-gravity oil daily through a ¼-in. choke with 725 lb. pressure on tubing and 600 lb. casing pressure. Gas-oil ratio is 350 to 1. Sand was topped at 5,652 ft. and total depth is 6,543 ft. Production is through 48 perforations at 5,652-57 ft.

There were 16 new locations reported this week, 7 being wildcats, 3 in Jefferson, and 1 each in Chambers, Colorado, Jackson, and Wharton counties. Of the 19 completions, 8 are wildcats, 3 successful tests, 1 each in Brazoria, Galveston, and Wharton, and 5 dry holes, 1 each in Matagorda, Polk, and Wharton counties, and 2 in Jefferson County. Fayette and Wharton counties shared the lead with three completions each.

UPPER GULF COAST SUCCESSFUL WILDCATS

Brazoria County: Old extension to Blue Lake field—Glenn H. McCarthy 1-T Thomas W. Masterson, Geo. Robinson Sur., Abst. 126, TD 10,549 ft., perf. 8,932-38 ft., PT 207 bbl. 24 hours, through 9/64-in. choke, gas-oil ratio 913, TP 1,475 lb., gravity 33°, Water 0.1 per cent.

Galveston County: New oil sand Hitchcock field—Stewarts 16 fee, Jas. Spillman Sur., TD 6,897 ft., perf. 6,523-26 ft., PT 162 bbl. 24 hours, through ⅛-in. choke, gas-oil ratio 387, TP 910 lb., casing sealed, gravity 33°, no water.

Wharton County: New oil sand, Boling field—Danciger 3 A. A. Mullins (OWWO), old TD 2,763 ft., old perforations 2,614-20 ft. squeezed, drilled out to 2,623 ft., and recompleted in

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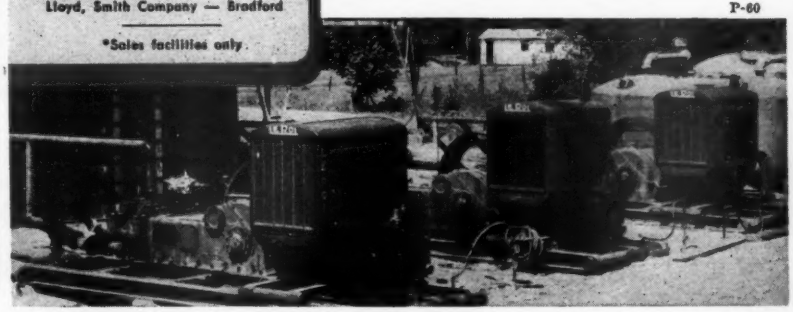

new sand through perforations 2,614-20 ft., PT 250 bbl. 24 hours, through 12/64-in. choke, gas-oil ratio 265, TP 240 lb., CP 490 lb., gravity 35°, no water.

UPPER GULF COAST WILDCAT FAILURES

Jefferson County: E. R. Brann et al 1 Anna Ebner, T&NO Sur., 6 mi. S Winnie, dry, TD 8,760 ft.

Glenn H. McCarthy et al 3 Hebert Trust, J. M., Wm. Sigler Sur., Abst. 48, dry, TD 10,367 ft.

Matagorda County: Montecito Oil of Dela. 1 Denman Kountz and J. T. Stewart III, I&GN Sur., Sec. 16, Blk. 8, dry, TD 8,804 ft.

Polk County: Jordan Drilling 1 Lynch Davidson & Co., Geo. Jamison Sur., Abst. 41, 2½ mi. W of Corrigan, dry, TD 6,503 ft.

Wharton County: J. F. Hutchins 1 Leslie Glaze, WCRR Sur., Abst. 384, 14 mi. N Louise, dry, TD 5,302 ft.

MICHIGAN

Deep River Field Adds Three Big Oil Wells

SAGINAW.—Wells coming in at hourly rates of flow of 320, 190 and 125 bbl. per hour added to the importance of the Arenac-Deep River field in the past week as Michigan operations resulted in 15 completions while 18 new locations were announced. Two other small producers, one in Bay County, another in Barry, were completed along with four gas wells. Three of the six dry holes were wildcat tests. Five of the new locations are in Arenac County, three each in Bay and Montcalm, one each in Gladwin, Gratiot, Kalamazoo, Mecosta, Roscommon, Oceana and Clare counties.

MICHIGAN WILDCAT FAILURES

Alcona County, Gustin Township: R. Paul Donahoe 1 Burton, NW NW SW 34-26n-8e, dry, TD 2,067 ft., deepened from 1,990 ft.

Kent County, Byron Township: Michigan Devonian Petroleum 1 Swainston, NE NE SW 30-5n-12w, dry, TD 1,819 ft.

Van Buren County, Porter Township: C. W. Collin 1 Hughes, NW NW NW 21-4s-13w, dry, TD 1,169 ft.

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PERMIAN BASIN

Offset to Dollar Hide Discovery Well Flows

MIDLAND.—The Dollar Hide pool in extreme southwestern Andrews County has its second producer in Magnolia Petroleum Co. 1-A Cowden, Section 7, Block A-55, Public School Land Survey, a west offset to the discovery well. On a 2-hour drill-stem test at 7,935-78 ft. there was gas to the surface in 1 hour and 40 minutes. The well kicked off and flowed after 36 stands of drill pipe had been pulled. An additional 47 stands of dry drill pipe then was pulled and the well again kicked off. Recovery was 3,690 ft. of oil, 900-ft. water blanket and 90 ft. of drilling mud. It was drilling below 8,015 ft. in chert.

Gulf Oil Corp. will drill 1-Z University, an east offset to the Mid-Continent Petroleum Corp. 1-15 University, which recently extended Devonian production in the Fullerton pool 2¼ miles southwest. The new test is 660 ft. from the north and west lines of Section 42, Block 13, University Lands.

A new pool has been opened in Howard County, 6 miles northwest of Big Spring, by Bruce McClardy 1 fee, Section 4, Block 33, T-1-N, T&P Survey. It has been completed on the pump for 28.32 bbl. of 28.3-gravity oil in 24 hours. Production is in the middle Permian at 3,100-51 ft. The well is 8 miles northeast of the nearest production. Stanolind Oil & Gas Co. 1 Mack Taylor, Section 8, Block B-2, Public School Land Survey, ½ mile east of the Keystone-Ellenburger field in Winkler County, took a 60-minute drill-stem test at 10,213-280 ft., using a 1,500-ft. water blanket. Recovery was the water blanket plus 1,170 ft. of mud, slightly gas cut, and 2,160 ft. of sulfur water.

Stanolind 1 Williamson, Section 5, Block 45, T-1-N, T&P Survey, deep test on the edge of the northwest Goldsmith pool, Ector County, ran a 3-hour drill-stem test in the basal Devonian. Recovery was 210 ft. of very heavily oil and gas-cut mud. There was no water. Operator was drilling ahead to Ellenburger. Francis A. Callery et al 7 Shannon, Section 27, Block WX, GC&SF Survey, has extended Ellenburger production in the Todd Deep pool of Crockett County. It was completed to flow 1,027 bbl. of 42.5-gravity oil daily through a ¼-in. tubing choke. Gas-oil ratio was 540 to 1.

Garza field, Garza County, had five completions this week and Fullerton field, Andrews County, and TXL field, Ector County, each had three. Andrews, Garza, and Ward counties each reported three new field locations this week.

In southeastern New Mexico, Artesia and Grayburg-Jackson fields, Eddy County, and Paddock field, Lea County, each had two completions. Lea and Eddy counties each reported one new field location.

WEST TEXAS SUCCESSFUL WILDCAT

Andrews County: Extension to old oil pool—Mid-Continent 1-15 University, Sec. 42, Blk. 13, University lands, 2¼ mi. S Fullerton-Devonian pool, elev. 3,292 ft., flowed 1,427 bbl. day through 10/64-in. choke on 2-in. tubing, perf.

8,590-8,650 ft. Devonian, gravity 45°, gas-oil ratio 1,553 to 1, TD 8,715 ft.

WEST TEXAS WILDCAT FAILURE

Crane County: Texas Gulf Prod. Co. 1 G. P. Lester, Sec. 42, Blk. 35, H&TC Sur., ½ mi. SW Crossett pool, elev. 2,342 ft., Devonian 5,180 ft., dry, TD 5,216 ft.

SOUTHEASTERN NEW MEXICO SUCCESSFUL WILDCAT

Lea County: New oil pay—Amerada 1-PB State, 16-23s-37e, Penrose Skelly field, elev. 3,332 ft., flowed 155 bbl. day, perf. 5,015-59 ft. Glorietta, gravity 38°, gas-oil ratio 511, TD 5,075 ft.

CALIFORNIA

Gardena Wildcat Not Commercially Productive

LOS ANGELES.—Ohio Oil Co., after a diligent effort extending over several months, has decided to abandon its Gardena wildcat as not commercially productive. Inability to effectively shut off water is the primary reason for abandonment at 10,594 ft. Ohio will not abandon the district as the initial wildcat showed too much in the way of oil to justify leaving the area. This well which made a number of flows on several production tests showed considerable promise at times and started off flowing at a daily rate of 750 bbl. The water cut continued to rise, however, and could not be corrected, despite many squeeze jobs. Present plans contemplate the drilling of a second well early in 1946, possibly east of the initial test.

Standard Oil Co. is making good progress with its wildcat in northern Washington near the Canadian border but it will be some time in early 1946 before the status of this wildcat will be determined. Standard's initial test is in Whatcome County and the last reported depth is 1,340 ft. The well is designated as 11-61-5 Ferndale Community. Richfield Oil Corp. which entered the northwest area several months ago has been given a lease on 2,000 acres of potential oil land by the Portland, Oregon, city council. This acreage is adjacent to 3,000 acres leased to Richfield by Multnomah County. Richfield is obligated to begin drilling operations within 60 days after the leases have been accepted. Texas Co. is already drilling a test adjacent to Portland, Oregon, but it is not yet deep enough to reach the projected pay. This wildcat is down a little over 1,000 ft. and making good progress with a diesel equipped rig.

Richfield Oil Corp. is still drilling ahead in 1 Union Unit in the Bandini district of Los Angeles Basin and coring practically all the way. This well which recently focussed the attention of operators on the Bandini area with a flow of 750 bbl. daily and about 1,000,000 ft. of natural gas was not completed because of a water cut approximately 42 per cent. The performance of the well indicates, however, that Richfield has found an excellent accumulation of oil and gas although it may take another hole to prove up the district as commercially productive. Bandini and Gardena, both bothered with persistent water trouble, are generally conceded to offer excellent prospects for production with additional drilling and both may be proved up during 1946. Standard's Leffingwell wildcat remains an enigma although another test appears justified as the oil sand found looked too good to prove unproductive. At La Mirada, General Petroleum is spot coring and shows some promise. This wildcat on a recent production test proved good for a small amount of oil and another location may find the top of the structure.

New locations this week just about equaled completions, indicating a temporary equilibrium. Drilling has been slowing up somewhat during the past several months but no drastic suspension has taken place.

CALIFORNIA WILDCAT FAILURES

Kern County, Fruitvale: General Petroleum 66-17 Calloway, 17-29s-27e, bottomed in hard gray sand, top Rio Bravo sand of Miocene age 8,606 ft., top of Vedder sand of Miocene age 8,684 ft., both sands barren, TD 10,052 ft.

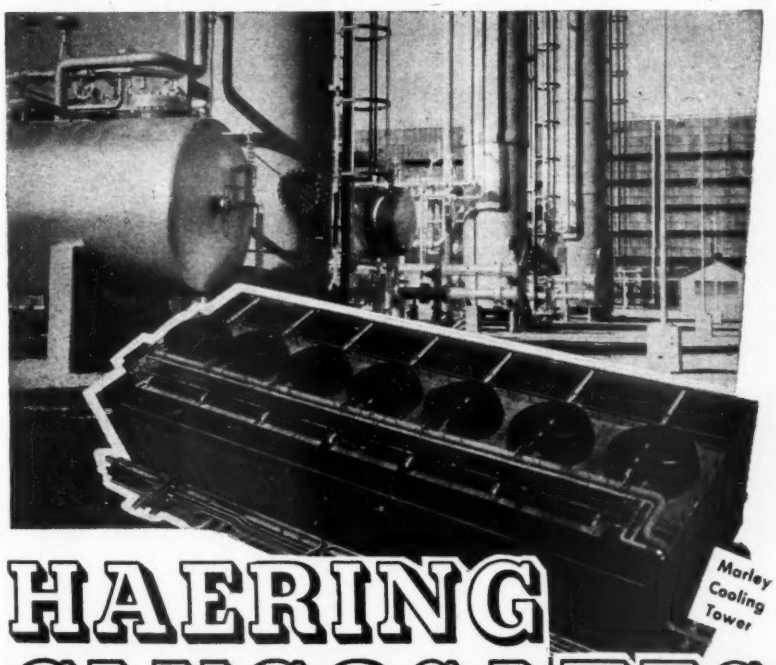
Jasmine: Beverly Trading & Exploration 1 Orange Land, 32-25s-27e, bottomed in gray sand, top Olcese sand 1,394 ft., top Pyramid Hills sand 2,175 ft., top Vedder sand 2,267 ft., all sands gray and barren, TD 2,279 ft.

ROCKY MOUNTAIN

Drilling Slowed in Area by Weather

DENVER. — Drilling operations in the Rocky Mountain area, which usually begin to slow down late in November and early in December of each year in anticipation of winter weather, were given a further setback the past week by the blizzard which in some areas sent the thermometer down to 20 below zero. A considerable number of wildcats located in exposed districts have shut down for the winter and most of them will not resume until next May or June.

Madison test for Cut Bank.—Following



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the recent completion of its 1 Brindley, NE NE 12-36n-6w, in the Madison lime in North Cut Bank, the Carter Oil Co. will test the lime in its 4 Jacobson, NW SW 23-37n-7w, 5½ miles northeast of the Brindley discovery, and located in the proven area of the field in the Cut Bank sand. This is an old well in the Sundance which was drilled to 2,640 ft. and plugged back to 2,455 ft. The Cut Bank field has had only two or three tests drilled below the top of the Ellis and following the Brindley discovery, the Madison as a potential producer is receiving considerable attention.

Southeastern Colorado failures. — Two wildcats in southeastern Colorado which have been closely watched are dry. Skelly Oil Co. 1 Hankins, SE SE NW 34-33n-44w, near Springfield, Baca County, which was located on the northwest trend from Pure Oil Co. 1 Oklahoma State, Cimarron County, Oklahoma, was dry at 6,172 ft. after testing the Arbuckle. It had some shows in the Lansing, but these proved uncommercial after backing up and testing. The other failure was Pacific Western Oil Co. and Frontier Refining Co. 1 Government, SW NW SE 12-26s-50w, Caddoa District, Bent County, which was dry at 5,994 ft. after testing the Arbuckle. Last named was drilled to expore the possibilities of a stratigraphic trap between two old wells drilled by the Marland Oil Co., one of which found all formations in place and the other encountered the granite at a shallow depth.

Carter outpost at Elk Basin.—Carter Oil 7-X Johnson, NE NW SW 8-57n-99w, an outpost in the southern part of the Elk Basin field, swabbed 10 bbl. an hour through 86 perforations at 5,796-5,826 ft., the crude testing 30.1° gravity. It is ½ mile west of the nearest Elk Basin producer and only 2 miles north of Continental Oil Co.'s South Elk Basin discovery made last July in its 1 Ida Goodstein, NE SE SW 20-57n-99w. No tests have been drilled between these two wells.

Christy Dome test.—Continental Oil Co. 1 Paige, SE NW NW 6-18s-64w, Christy Dome, Pueblo County, Colorado, a Pennsylvanian test, cored the Dakota sand at 2,031-51 ft. and recovery showed water with traces of dead oil. Ground elevation is 5,248 ft.

New operations.—Nine new operations were reported, of which three are in the Rangely field, Colorado, one in the Big Muddy field in Wyoming, and three in Cut Bank, one in the Baker gas field and one in Kevin-Sunburst, in Montana. The only wildcat is the Carter Oil Co. 4 Jacobson, an old well in Cut Bank which is to be deepened to test the Madison.

Completions. — Seventeen wells were completed in the Rocky Mountain area, of which 10 were in Montana, 3 in Colorado, and 4 in Wyoming. Of these 11 were oil wells, with initial output of 875 bbl., 2 were gas wells, and 4 were dry holes. Three were wildcats, all dry, and all in Colorado. Nine Montana completions included five in Kevin-Sunburst, two in Cut Bank, one in Cat Creek and one in the Baker gas field. Wyoming had one each at Elk Basin, Oil Springs, Lance Creek and Hamilton.

COLORADO WILDCAT FAILURES

Caddoa, Bent County: Pacific Western Oil and Frontier Refining 1 Government, SW NW SE 12-26s-50w, TD 5,994 ft., Kansas City lime 3,220 ft., Mississippian 5,599 ft., Simpson 5,917 ft., Arbuckle 5,935 ft., dry.

Ojo-Oakview, Huerfano County: Gled Oil 1 Yacconi, NE NE SW 10-29s-69w, TD 386 ft., dry.

Springfield, Baca County: Skelly 1 Hankins, SE SE NW 34-33n-44w, TD 6,172 ft., dry, uncommercial show in Lansing, Lansing 3,501 ft., Mississippian 5,450-6,052 ft., no Viola, Simpson 6,052 ft., Arbuckle 6,066 ft.

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CANADIAN FIELDS

Alberta Completions Total Seven Oil, Two Gas

CHATHAM.—Official figures have been issued on the following recent Alberta completions:

Turner Valley West Central.—Royalite Oil 83, LSD 13, 19-19-2w5, Madison 6,874-7,113 ft., 57 bbl. 42-gravity oil with 230,- cu. ft. gas.

Turner Valley South.—Mercury-Mill City 1, LSD 10, 16-18-2w5, Madison 6,437-6,801 ft., 49 bbl. 45-gravity oil with 882,000 cu. ft. gas.

Conrad.—Conrad-Province 75-33-B, LSD 12, 33-5-15w4, total depth 3,077 ft., pumping 118 bbl. 26 gravity. Conrad-Province 13-32-B, LSD 8, 32-5-15w4, total depth 3,096 ft., pumping 98 bbl. 26 gravity.

Lloydminster. — S.A.C. (Alta) Oils 2, LSD 1, 12-49-1w4, total depth 1,874 ft., pumping 24 bbl. 14 gravity.

Hay Lake Dome.—Admiral-British Dominion 1, LSD 7, 22-1-17w4, total depth 3,094 ft., pumping 51 bbl. 31 gravity.

Val Dome.—Martin 1, LSD 2, 17-42-6w4, total depth 3,000 ft., 104,000 cu. ft. gas from 2,310 ft.

Medicine Hat.—Medicine Hat 67, LSD 6, 24-13-6w4, total depth 1,205 ft., 4,210,000 cu. ft. gas.

Steveville.—Princess-C.P.R. 18-22-A, LSD 16, 22-20-12w4, total depth 3,961 ft., pumping 11 bbl. 30 gravity.

Antelope Hills.—On the Antelope Hills structure in eastern Alberta, Trans Al-

berta-Alliance 1, LSD 15, 19-20-1w4, is deepening below 3,551 ft. with Devonian limestone expected around 3,700 ft. California-Standard Co. has taken up holdings of 399,834 acres on three sides of this test, and just west of the Boundary-Horsham 1, LSD 10, 26-17-29w3, in Saskatchewan where some oil shows have been encountered.

Moose Dome.—On the Moose Dome structure in the foothills northwest of Calgary, Elbow Falls 2-A, LSD 4, 28-22-6w5, at 2,610 ft. has encountered sulfur gas with traces of oil. Test will be made immediately after the Christmas holidays.

Brazeau.—In the Central Alberta foothills, Home-Brazeau 1, LSD 5, 17-43-17w5, after faulting back from the Madison, reentered lower Blairmore at 9,819 ft. and is deepening toward the lime at 10,314 ft. South and east in the same general area, Imperial-Shell-Stolberg 1, LSD 3, 22-41-14w5, is also in Blairmore below 9,919 ft. with a deep test indicated.

APPALACHIAN FIELD

Fayette County Test Hits Two Gas Pays

PITTSBURGH.—On Chestnut Ridge in Georges Township, Fayette County, southwest Pennsylvania, Manufacturers Light & Heat Co. topped the Onondaga chert at 7,172 ft. and ran casing. At 7,218-32 ft. and at 7,260-62 ft. where it is now drilling, there were gas pays totaling 446,000 cu. ft. It is drilling ahead to the Oriskany and apparently running high on structure.

In German Township, Fayette County, Nollem Oil & Gas Co. completed a test on Leslie Moser farm in the gas sand with a gage of 1,300,000 cu. ft. gas. The sand was topped at 770 ft. with the gas at 776 ft. and total depth 779 ft.

Among the new wildcats starting, Appalachian Development Corp. is spudding in a test on Alfred Halm farm, elevation 1,317 ft., in Greene Township, Erie County, northwest Pennsylvania. New locations just announced consist of one in Kittanning Township, and two in Wayne Township, Armstrong County, and one in Washington Township, Westmoreland County.

In West Virginia, Columbian Carbon Co. topped the Corniferous lime at 4,728 ft. in the test 825 G. S. Barnhart in Ravenswood district, Jackson County, and shut down to run 7-in. casing after which it will be drilled through to the Oriskany. Here, United Carbon Co. topped the Corniferous at 4,694 ft. in the test 1,295 Elias Balser and set casing at 4,709 ft. in this district, United Fuel Gas Co. is drilling at 4,578 ft. in the test 5,738 Miriam Harsman. In this area there have been some large Oriskany gas wells.

In Elk district, Kanawha County, northeast of Charleston and an extension of the new Oriskany development east of the old Elk-Poca field, Columbian Carbon Co. topped the Corniferous lime at 5,132 ft. in the No. 3 C. W. Cavender, formerly a Weir sand well of the Empire Petroleum Co. After running casing, it is now deepened to 5,229 ft. or within a few feet of the Oriskany.

In Green district, Wetzel County, G. F. Eagon completed a test on the G. S. Gorley farm good for 687,000 cu. ft. gas from the Injun sand, total depth 1,810 ft.

New locations announced during the week total 10 which include 1 to the Oriskany in Ravenswood district, Jackson County. The others are scattered in Union district, Kanawha County; Union district, Ritchie County; Butler district, Grant district, and Lincoln district, Wayne County; Clay district, Wetzel County; Baileysville district and Oceana district, Wyoming County.

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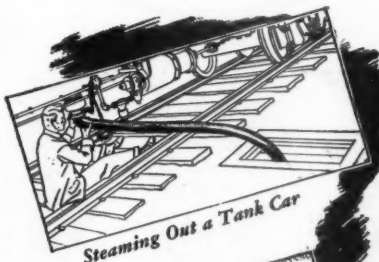
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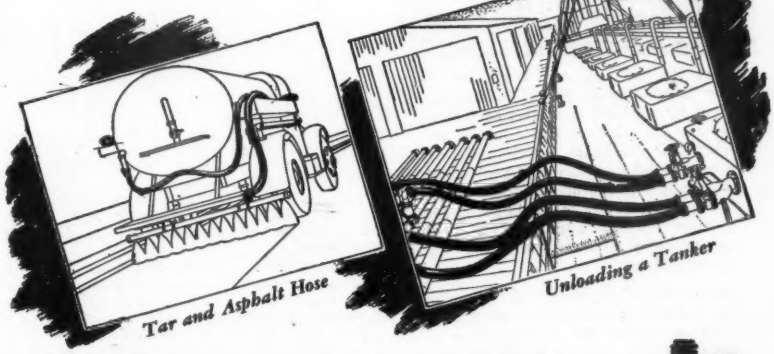
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N. CENTRAL TEXAS

Clay County Wildcat Finds Two Oil Pays

WICHITA FALLS.—Continental Oil Co. 1-C Heard, section 3222, TE&L Survey, Abstract 583, wildcat 3 miles southeast of Joy, Clay County, drilled to 6,493 ft. and topped Ellenburger at 6,460 ft. Seven-inch casing was set at 6,468 ft. Plug was drilled, it was washed with water and it flowed 240 bbl. of oil in 24 hours through 24/64-in. choke. Casing pressure was 850 lb. and tubing pressure 100 lb. The well also showed oil on a 1-hour drill-stem test of the Caddo at 5,740-81 ft. Recovery was 1,435 ft. of oil and 300 ft. of oil-cut mud. Standard Oil Co. of Texas 1 A. J. Mitchell, J. B. McNarr Survey, proposed 10,500-ft. wildcat 1½ miles northwest of Sherman, Grayson County, has set 12½-in. casing at 2,540 ft. and is waiting for cement to set. Total depth is 2,664 ft.

Continental 1 Jarrell, Block 3433, TE&L Survey, wildcat 8 miles south of Bowie Station, Montague County, topped the Caddo at 5,705 ft. On a 48-minute drill-stem test at 5,715-34 ft., gas came to the surface in 20 minutes and recovery was 210 ft. of oil, 180 ft. of oil-cut mud and no water. Bottom-hole pressure was 1,925 lb. Operator was drilling ahead, probably to the Ellenburger. Continental 1-A Yowell, Block 6, Limestone County School Land Survey, outpost to the Johnson pool of western Montague County, northeast of Stoneburg, flowed 524 bbl. of oil in 4½ hours through 1-in. tubing choke. Production is from the lower conglomerate at 6,178-92 ft.

KMA field, Wichita County, had five completions this week and the Gatewood field, Cooke County, had four. Archer County had eight new field locations and Wichita County had seven.

In West Central Texas, Jones County had six field completions. Noodle field, Jones County, reported two new locations.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Benson Bros. 1 L. F. Wilson, Blk. 99, ATNCL Sur., 8 mi. S Holliday, elev. 1,035 ft., dry, TD 1,603 ft.

Frank Hutcheson 1 Wilson, Sec. 121, ATNCL Sur., 4 mi. N Holliday, elev. 968 ft., dry, TD 2,302 ft.

A. C. Parker 1 Benson, Lot 10, Jefferson CSL, elev. 1,167 ft., dry, TD 1,170 ft.

Baylor County: P. C. Burns 1 T. Syptalc, Sec. 213, T&NO Sur., 7 mi. E and 1 mi. S Seymour, dry, TD 2,881 ft.

Clay County: L. T. Burns 1 A. Grinke, Lot 17, Halsell Subd., 1½ mi. E Hassell, elev. 1,015 ft., Ellenburger 5,881 ft., dry, TD 6,017 ft.

Consolidated Oil and Premier Oil 1-C Blatner, Sec. 3, MEP&P Sur. A-332, elev. 955 ft., Caddo 6,080 ft., dry, TD 6,505 ft.

Cooke County: J. E. Meredith 1 E. L. Miller, G. W. Hawkins Sur. A-474, 4 mi. E and 3 mi. S Gainesville, elev. 817 ft., dry, TD 2,708 ft.

Jack County: Paul, Brisco & Ferguson 1 Willis, Geo. H. Duncan Sur. A-175, 1 mi. E and ¼ mi. S Gibtown, elev. 1,151 ft., dry, TD 1,800 ft.

Wise County: H. W. Snowden 1 Ella Thomas, Lot 27, Matagorda CSL Sur. A-535, 1 mi. W and 3 mi. S Bridgeport, elev. 837 ft., dry, TD 4,070 ft.

Young County: G. E. Kadane & Sons 2 Allar Co. et al, Sec. 3410-D, TE&L Sur., 7 mi. E. Murray, elev. 1,197 ft., Palo Pinto 1,565 ft., dry, TD 2,884 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCAT

Jones County: New oil pool — Rhodes

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Drilling 1 W. D. Swann, I. Miley Sur. No. 281, 5 mi. SW Noodle, elev. 1,868 ft., flowed 499 bbl. day through ¼-in. choke on 2-in. tubing, perf. 2,760-71 ft. Saddle Creek, TD 2,953 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: M. M. Travis 2 A. M. Heranius, Sec. 164, BBB&C Sur., 8 mi. N Leuders, elev. 1,562 ft., Strawn 3,277 ft., dry, TD 4,585 ft.

Stonewall County: A. R. Dillard 1 G. T. Sparks, Sec. 161, Blk. 1, H&TC Sur., 12 mi. SE Aspermont, elev. 1,937 ft., Canyon 4,750 ft., Reef 5,402 ft., dry, TD 6,110 ft.

LA.-ARK.

Franklin Parish Wildcat Tests 10 Bbl. Per Hour

SHREVEPORT.—Gus K. Primos and C. W. Sharp 1 Butler, SW NW 20-16n-8e, a Franklin Parish wildcat 6 miles south of Big Creek field, is building tanks. Operators have shut off water, and the well is standing at 3,787 ft., after testing 10 bbl. of oil per hour.

C. L. Halbouty et al 1 Detro, NW SE 1-13n-8w, a wildcat in Natchitoches Parish, is preparing to run pipe for production tests. A drill-stem test at 3,295-96 ft. recovered 500 ft. of oil, 70 ft. of salt water and 20 ft. of drilling mud.

Completions in North Louisiana totaled 15, including 4 oil wells, 3 gas wells, and 8 dry holes. One gas wildcat was completed in Bienville Parish, and four wildcats were failures. In the Arkansas fields, one oil well was added to the Stephens field, and Fouke and McKamie fields completed one dry hole each.

NORTH LOUISIANA SUCCESSFUL WILDCAT

Bienville Parish: Ohio 1 Crow, SW NW 32-17n-7w, 2,072,000 cu. ft. gas from Travis Peak at 7,535-48 ft., TD 7,689 ft.

NORTH LOUISIANA WILDCAT FAILURES

Avoyelles Parish: Crosby Drilling et al 1 Snowden estate, 3,705 ft. east and 280 ft. south of NW corner of 22-3n-5e, dry, TD 8,059 ft.

Caldwell Parish: Crescent Drilling 1 Louisiana Central, 660 ft. west and 300 ft. south of NE corner of NE SE 25-13n-3e, dry, TD 3,567 ft.

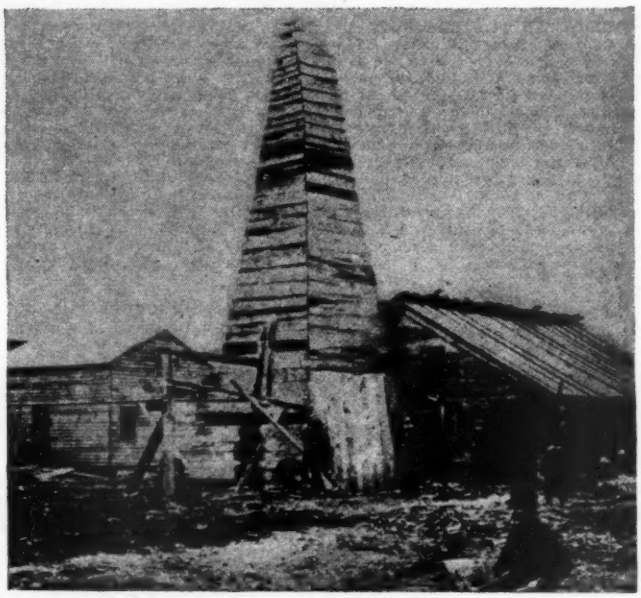
LaSalle Parish: H. L. Hunt F-129 Nebo, 1,980 ft. north and 660 ft. east of SW corner of 25-8n-2e, dry, TD 7,481 ft.

Madison Parish: Sohio 1 Anderson-Tully, 2,970 ft. south and 2,988 ft. west of NE corner of 24-16n-13e, dry, TD 7,200 ft.

OKLAHOMA

Garvin County Wildcat Drilling Ahead

MOST closely watched wildcat in Oklahoma at the close of the week was the Globe-Vickers 1 Gibson, SE NE 30-3n-2w, southwest of Antioch in Garvin County. A second drill-stem test was not too promising, but several stray zones have reportedly been encountered following a flow of oil and gas from the basal Pennsylvanian. Base of the Pennsylvanian and top of the Henryhouse-Haragan lime was at 6,602 ft., cutting off the Woodford and the Bois d'Arc. Top of the Chim-



Famous Facts

Today's gigantic petroleum industry was born on August 27, 1859, when Colonel Edwin L. Drake drilled the first oil well in the world on the banks of Oil Creek, near Titusville, Pa. Oil from the Drake well brought $20 a barrel, but derricks soon dotted the hillsides of Pennsylvania, and in less than three years the price was down to 10c.

About this same time, Bitumastic Enamel — the first product of its kind — was introduced as a protective coating for ship surfaces exposed to severe corrosive conditions.

Since then Bitumastic Enamel has established record after record in resisting corrosion on thousands of miles of oil, gas and gasoline pipe lines.

Bitumastic Enamel combines such qualities as high viscosity, good adhesion and flexibility, to provide a coating that resists all types of corrosive soils.

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ney Hill was at 6,790 ft., with the Sylvan shale at 6,821 ft.

On a 58-min. drill-stem test at 6,758-6,833 ft., the 420-ft. water load and 90 ft. of drilling mud were recovered; there was no show of oil or salt water. Earlier in the week a drill-stem test in the basal Pennsylvanian sand at 6,519-54 ft., recovered an estimated 6,000,000 cu. ft. of gas in 6 minutes, with the hole cleaning itself in 25 minutes to flow by heads for 10 min. making considerable oil, but no salt water. After the well had been shut in all night, the tester was pulled and 500 ft. of clean oil and 4,000 ft. of oily mud were recovered. Flowing pressure was 1,500 lb. and shut in pressure was 2,700 lb. Crews were reported drilling ahead Saturday at about 6,850 ft.

Globe Oil & Refining Co. 1 Novell, NE SW SW 20-7n-7e, near the Little River pool of Seminole County, drilled a sand at 2,300-40 ft. late last week and blew out the tools with a gas flow estimated at 10,000,000 cu. ft. The well caught fire and burned for 24 hours before being brought under control late Friday. Drill pipe was still in the hole and derrick and equipment were wrecked. When a new rig is installed, the well will be drilled deeper.

A new Wilcox sand test for the Anadarko Basin will be drilled by Oklahoma Natural Gas Co. on a large block in eastern Dewey County. The company has staked location for 1 Green in NW NW NW 6-17n-14w, northwest of the town of Oakwood. Contract is for 10,000 ft. This new project is a southwest offset to a Magnolia test which made some condensate but was abandoned after losing the hole at 9,478 ft. The condensate and some gas came from the Layton sand at 7,665 ft.

OKLAHOMA SUCCESSFUL WILDCATS

Logan County: New oil pool—Phillips 1 Mize, SE SE 25-18n-4w, flowed 568 bbl. from Layton at 4,783-4,812 ft., TD 4,862 ft., Layton 4,782 ft.

Noble County: New oil pool—Deep Rock 1 White, SW NE NE 19-23n-2w, flowed 462 bbl. and 11,500,000 cu. ft. gas from sandy dolomite at 4,434-50 ft., TD 4,450 ft., Misener 4,383 ft., Sylvan 4,388 ft., lime 4,393 ft., sandy dolomite 4,415 ft.

OKLAHOMA WILDCAT FAILURES

Hughes County: Eugene Jordan 1 Wacker, SE NW SW 11-8n-8e, dry, TD 4,290 ft., second Wilcox 4,265 ft.

Logan County: F. Morgan 1 Carpenter, SE SW SW 35-16n-1w, dry, TD 5,215 ft., Oswego 4,960 ft., Verdigris 5,100 ft., Bartlesville 5,215 ft.

Okfuskee County: McIntyre et al 1 Curry, SE NE NW 20-12n-8e, dry, TD 3,834 ft., Wapanuka 3,775 ft., Cromwell 3,787 ft.

Pottawatomie County: Globe Oil & Refining 1 Romberg, NE NE SW 23-10n-4e, dry, TD 4,939 ft., Red Fork 4,054 ft., brown lime 4,275 ft.

Panner et al 1 Fratt, NW NE 2-8n-4e, dry, TD 4,400 ft., Hunton 4,312 ft., Sylvan 4,399 ft.

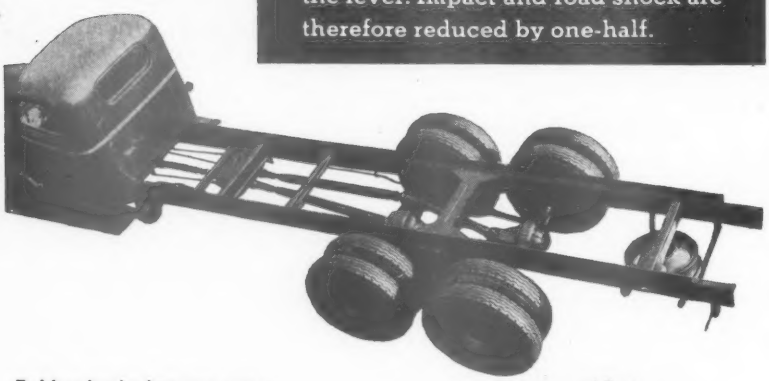
Fabco DUAL DRIVE with Power Selector

DISTRIBUTORS WANTED

Distributors are wanted in certain territories still open in the East, South and Mid-West. ☆ Write for our distributors proposition now!

Spring suspension is of the "Inverted Semi-elliptic" Type, pivoted to the truck frame at their center point with ends floating free on each axle.

The weight of the springs is "Sprung Weight." They act as a balance lever between the two axles, cutting frame lift in half due to the 2 to 1 ratio of the lever. Impact and road shock are therefore reduced by one-half.



Rubber bushed torque arms in a "Parallelogram System" prevent the axles from rolling over . . . always maintain them in a vertical position . . . and transmit driving and braking torque. ☆ The bushings are easily and cheaply replaced; require no lubrication; and are not affected by mud, dust, or oil.

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OHIO, KENTUCKY

New Gas Pool Has North Extension

COLUMBUS.—The new gas pool in the southeast part of Perry Township, Ashland County, Ohio, had a south extension in Ohio Fuel Gas Co. 1 E. S. Spotts, Section 26. Clinton sand at 2,848-59 ft. gaged 887,000 cu. ft. natural. West and north offsets will be drilled.

Hanley and Bird's semiwildcat test on Ira Schwartz, Lot 33, in the northeast part of LaGrange Township, Lorain County, found a thin lens of Clinton sand at 2,436-40 ft. with a show of gas. After a shot, the well was shut in at 240,000 cu. ft. Two additional wells are planned to further test the area.

Ditch and Gerig 2 E. E. Drake, Lot 32, Sullivan Township, Ashland County, found a total of 711,000 cu. ft. in pays in the Berea, Shell and Clinton sands.

Atha 2 H. H. Roberts, Section 23, Newton Township, Muskingum County, was drilled 7 ft. in the Clinton, topped at 3,382 ft. Gas gaging 472,000 cu. ft., will be used this winter before the well is deepened to the oil pay.

Twenty-nine locations were reported with Lancaster field having eight. Of the 19 completions, Ashland-Lorain led with 9.

WESTERN KENTUCKY

OWENSBORO.—In the area 2 miles east of Corydon, Henderson County, F. Fleming et al 1 Kitty Green, 1-O-22, is showing for a good oil well. The 1 Green is now testing after drilling plug on the McClosky at 2,620-25 ft., total depth. If the well is successfully completed, it will open the second pay zone for this area.

Joe Engberg 1 Blake Bros. 22-P-20, Union County wildcat 1 mile southwest of Robinsonville, flowed at the rate of 2 bbl. of oil an hour after perforations in the McClosky. This well opens a new producing area.

WESTERN KENTUCKY WILDCAT FAILURE

Union County: Sun Oil Co. 1 Waller Bros., 9-O-19, dry at 2,730 ft., Menard 1,762 ft., Waltersburg sand 1,873-1,908 ft., Glen Dean 2,008-65 ft., Cypress 2,329-2,481 ft., Aux Vases 2,577 ft., Ste. Genevieve 2,597 ft.

ILLINOIS

White County Wildcat Has Oil Show in Aux Vases

MATTOON.—White County had prospects of a new field last week when J. J. Lynn 1 Earhardt, NE NE 12-5s-8e, found a show of oil in the Aux Vases sand at 3,159-68 ft. The 1 Earhardt is being tested at present but results of the tests have not been learned. It is approximately 3½ miles northwest of the Trumbull pool.

In Wayne County, Olson Drilling Co. 1 Roush, NE SE NE 15-1n-7e, a prospective pool opener, has been put on pump to test the McClosky lime at 3,128-33 ft., total depth. A 1-hour drill-stem test of this formation got gas in 25 min., 120 ft. of clean oil, and 60 ft. of oil-cut mud.

During the past week Illinois gained 28 new oil producers which added 3,865 bbl. of oil daily to the state's production. In addition, 14 wells were completed as failures. The Mattoon field of Coles County again dominated the week's activity with 7 new oil wells and 4 dry holes.

Drilling activity showed a slight upward trend with the announcement of 53 new tests. Of these, 18 were wildcats located in several different counties.

ILLINOIS WILDCAT FAILURES

Clinton County: H. J. Schlafly 1 G. Hahn, NE NW NW 11-2n-1w, dry at 1,720 ft., Menard 991 ft., Tar Springs sand 1,097 ft., Glen Dean 1,181 ft., Golconda 1,245 ft., Cypress sand 1,372 ft., Benoist 1,485 ft., Benoist sand 1,490 ft., Aux Vases sand 1,573 ft., Ste. Genevieve 1,631 ft., Rosiclare 1,650 ft., Fredonia 1,668 ft.

Coles County: B. A. Baker 1 C. W. Sellew, NE SE NW 31-12n-8e, dry at 2,237 ft., Glen Dean 1,841 ft., Barlow 1,925 ft., Cypress sand 1,962 ft., Paint Creek 2,013 ft., Renault 2,096 ft., Aux Vases sand 2,104 ft., Ste. Genevieve 2,140 ft., Rosiclare 2,176 ft.

Perry County: Southwestern Oil 1 Crawford, SE NE SW 29-4s-3w, dry at 1,750 ft.

Richland County: John Washburn 1 E. J. Levitt, SW½ SW NE 22-3n-9e, dry at 3,118 ft., Glen Dean 2,464 ft., Cypress sand 2,721 ft., Paint Creek 2,829 ft., Ste. Genevieve 2,994 ft., McClosky 3,019 ft.

Wabash County: C. Wood 1 Wm. Raber, SE SE SE 7-2s-13w, dry at 2,868 ft.

Record Savings Reported By Cooperative Group

KANSAS CITY.—Net savings of $1,766,507 on a volume of business totaling almost $27,000,000 for the fiscal year ended August 31, were reported by Consumers Cooperative Association, which has large petroleum operations. Both net savings and volume of business exceeded all previous records, according to Howard A. Cowden, president and general manager, reporting at the seventeenth annual meeting. "Savings" is the term used to describe the organization's income.

The savings for the preceding year were $1,525,804 on volume of $16,388,229, and for the period ended August 1, 1943, $866,613 on $15,248,135.

Savings placed in a revolving fund 5 years ago to help capitalize the

The World's Standard of Quality in Oil Field Equipment - - -

Acme — Since 1900

Pattin — Since 1888

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RUGGEDNESS - -

There are Pattin Units Still "Going Strong" After 40-Odd Years' Constant Service - - -

Recently we visited some Pattin "Old Timers"—Engines and Pumping Powers installed in 1903-4-5 and still serving well. And Compressors that have run 30 years, day and night. All are most convincing proof that Pattin's RUGGEDNESS, in comparative ***slow*** speed units, pays ***extra*** dividends, through ***life-long*** dependable performance.

The same stamina — plus more efficient and economical operation — that has made Pattin oil country equipment famous among two generations of owners is still the ***safe*** and ***sane*** foundation upon which our present day units, of improved design, are built.

With the present trend confirming our long experience, by favoring Pattin type lower speed, single cylinder, heavy duty engines, we shall continue building them — incorporating those qualities which assure more ***reliable*** power, LONGER, and lower service cost, all resulting in greater footage drilled or oil volume lifted per dollar invested.

Acme's 18" Safety Wire Line Clamp—

Fig. 103

Surest, safest, strongest for deep well drilling. Non-fouling safety links — tested to 208,500 lbs. breaking load. More gripping surface, permits loading up to 25 tons. Feature of both 18" and 12" Acme Clamps is slip retainers grooved to grip sand line . . .Use 12" size for drilling to 3000 ft. and 18" size for depths more than 3000 ft.

See Acme — Composite Catalog.

Typical Testimonials —

78-year old owner said: "My 42-year old Pattin Engine I've run every day."

Another said: "My Dad bought a Pattin 18 H.P. in 1904 which gives me excellent service." . . . Drilling contractor: "My Pattin 40 away out-pulls any I've ever seen." . . . Owner, 30-year old Pattin Compressor: "No mechanical defects yet and it runs continuously." Pattin pumping power owner: "I can practically 'forget it' between oilings."

PATTIN BROS. ENGINES POWERS — COMPRESSORS

"GLUTTONS for Life-Long Punishment"

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WATER CANS & COOLERS

GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push Button Faucet at slight additional cost)

GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. Gott Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today.

GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push Button Faucet

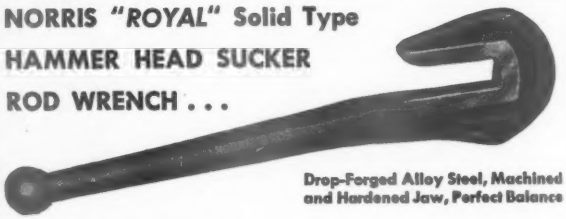
H. P. GOTT MFG. CO.
WINFIELD, KANSAS

KEEP YOUR DRINKING WATER ALWAYS HANDY

INSIST ON THE GENUINE
Look for the Blue and Black Label
with the name GOTKOOL in Red

BUILT TOUGH
To Take Plenty of Punishment!

NORRIS "ROYAL" Solid Type
HAMMER HEAD SUCKER
ROD WRENCH . . .



Drop-Forged Alloy Steel, Machined and Hardened Jaw, Perfect Balance

NORRIS "BUMP-UP"
Hinged Type SUCKER
ROD WRENCH . . .

Drop-Forged, Heat-Treated Alloy Steel Jaw; Perfect Balance; Opening Machined to Exact Dimensions

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association were distributed in cash at the meeting. These 5-year-old savings were $51,879. Directors have recommended to members that savings made in the latest fiscal year be allocated and payment deferred at the directors' discretion, to capitalize the organization more adequately.

Of the $27,000,000 volume, more than $17,000,000 came from the cooperative's own facilities.

CALENDAR

1946

January

SAE, annual meeting, Book-Cadillac Hotel, Detroit, January 7-11.

FPC regional hearing in natural-gas investigation, Court House Building, Houston, January 28.

Independent Natural Gas Association of America, annual membership meeting, Texas State Hotel, Houston, January 28.

February

American Welding Society, national meeting, Hotel Cleveland, Cleveland, February 4-7.

Iron and Steel and Institute of Metals divisions, American Institute of Mining and Metallurgical Engineers, national meeting, Statler Hotel, Cleveland, February 4-8.

American Society for Metals, annual convention (postponed from 1945), Statler Hotel, Cleveland, February 4-8.

FPC regional hearing in natural-gas investigation, Buena Vista Hotel, Biloxi, Miss., February 11.

FPC regional hearing in natural-gas investigation, Chicago, February 19.

American Society for Testing Materials, spring meeting, Pittsburgh, February 25-March 1.

Exposition of Chemical Industries, twentieth exposition, Grand Central Palace, New York, February 25-March 2.

March

FPC regional hearing in natural-gas investigation, Charleston, W. Va., March 19.

Southern Gas Association, annual convention, Galveston, March 21-22.

April

American Association of Petroleum Geologists, annual meeting, Stevens Hotel, Chicago, April 2-4.

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, April 18-19.

May

Natural Gas Department, American Gas Association, annual spring meeting, Hotel Gibson, Cincinnati, May 7-8.

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

June

American Society for Testing Materials, annual meeting, Buffalo, June 24-28.

LEGAL

OIL AND GAS LEASE

UNITED STATES DEPARTMENT OF AGRICULTURE, Forest Service, Jackson, Mississippi, December 21, 1945. Sealed bids in duplicate will be received until 10:00 A.M., Central Time, January 21, 1946, and then publicly opened, offering bonus for operating rights in connection with gas and oil leases on six blocks of national forest land which are divided into eighteen parcels, located in Newton, Amite and Franklin Counties, Mississippi. Block number one contains Parcel A of approximately 846.02 acres, more or less, in Township 5 North, Range 10 East, Section 21, NE¼; N½ SE¼; Section 22, SW¼; W½ SE¼ less a strip 3.18 chains wide off the East side, containing 12.69 acres, more or less; Section 27, NW¼ NE¼; NW¼ less 2 acres in a square in the NW corner of NW¼ NW¼; N½ SW¼; and SE¼ SW¼; Section 28, E½ NE¼ less the North 15 acres. Parcel B of approximately 767.21 acres, more or less, in Township 5 North, Range 10 East, Section 20, W½ SE¼; Section 21, NE¼ NW¼; S½ NW¼; SW¼; Section 28, NW¼; NW¼ SW¼; N½ NE¼ SW¼; N½ SW¼ SW¼; SW¼ SW¼ SW¼; Section 29, SE¼ NE¼; NE¼ SE¼ and S½ SW¼. Block number two contains Parcel A of approximately 565.95 acres, more or less, in Township 5 North, Range 3 East, Section 18, S½ SE¼; Section 19, E½; E½ W½. Parcel B of approximately 768.20 acres, more or less, in Township 5 North, Range 4 East, Section 7, SE¼; S½ SW¼; Section 18, E½ E½; W½ W½; NE¼ NW¼ NW¼ NE¼; N½ SW¼ NE¼; SE¼ SW¼ NE¼; E½ NW¼ SE¼; N½ SE¼ NW¼; SW¼ SE¼ NW¼; W½ E½ SW¼. Parcel C of approximately 430.81 acres, more or less, in Township 5 North, Range 4 East, Section 8, SW¼; Section 17, NW¼; W½ NE¼; NW¼ SE¼. Block number three contains Parcel A of approximately 475.54 acres, more or less, Township 5 North, Range 3 East, Section 30, Lots 6, 7, 8 and 9; Section 37, NE¼; N½ S½. Parcel B of approximately 405.21 acres, more or less, in Township 5 North, Range 3 East, Section 31, S½; Section 32, W½ SW¼. Parcel C of approximately 640.52 acres, more or less, in Township 5 North, Range 3 East, Section 36, entire; Parcel D of approximately 440.42 acres, more or less, in Township 5 North, Range 3 East, Section 35, NW¼; NW¼ SW¼; S½ SW¼; SW¼ SE¼; Section 44, NW¼ NE¼; N½ NW¼. Block number four contains Parcel A of approximately 506.32 acres, more or less, in Township 4 North, Range 3 East, Section 7, E½ E½; Section 8, W½. Parcel B of approximately 507.51 acres, more or less, in Township 4 North, Range 3 East, Section 8, E½; Section 9, W½ W½. Parcel C of approximately 839.38 acres, more or less, in Township 4 North, Range 3 East, Section 17, entire; Section 18, E½ E½. Block number five contains Parcel A of approximately 673.48 acres, more or less, in Township 4 North, Range 3 East, Section 1, entire. Parcel B of approximately 623.95 acres, more or less, in Township 4 North, Range 3 East, Section 2, N½; N½ SE¼; SE¼ SE¼; Section 11, E½ NW¼; N½ NE¼. Parcel C of approximately 694.45 acres, more or less, in Township 4 North, Range 3 East, Section 12, N½; NE¼ SE¼ and Township 4 North, Range 4 East, Section 6, W½. Block number six contains Parcel A of approximately 456.36 acres, more or less, in Township 5 North, Range 4 East, Section 30, SE¼; E½ NE¼; SW¼ NE¼; S½ SW¼; NE¼; SW¼; S½ NW¼ SW¼; NE¼ NW¼ SW¼; S½ SE¼ NW¼; NE¼ SE¼ NW¼. Parcel B of approximately 558.93 acres, more or less, in Township 5 North, Range 4 East, Section 31, N½; SW¼; W½ SE¼. Parcel C of approximately 505.17 acres, more or less, in Township 5 North, Range 3 East, Section 34, Portion of SE¼ SE¼ South and East of Steele's Creek; Section 45, E½; E½ SW¼; SW¼ SW¼; E½ SE¼ NW¼; SW¼ SE¼ NW¼. Bids may be submitted for an entire block or separately for any or all parcels thereof, or in both ways. If the aggregate of the several high bids on the individual parcels of a specific block exceeds the maximum bid for the block as an entirety, the bids on the parcels will be accepted. If, however, a bid on a block as an entirety is higher than the aggregate of the high bids on the several parcels thereof, then the bid on the entire block will be accepted. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms and operating regulations from the Forest Supervisor, Masonic Building, U.S. Forest Service, Jackson 114, Mississippi.

MARKET QUOTATIONS

Prices as of December 26, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	75-78
Mid-Continent*	6.375-6.75	5.625-6.00
Gulf Coast	6.75	5.750
Northeast Coast	...	6.875
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1938 C.F.R. (research method).

NATURAL GASOLINE

Grades:	25-70	10-34
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	3.500	4.250
North Louisiana (f.o.b. plant)	3.750	4.500
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.35
Conroe	1.40
Tepetate, Louisiana, avg. grav.	1.20
Illinois Basin	1.27
Pecos County, Texas	.85
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.00

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	...	...	...
19-19.9	.84	...	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.29	.92
31-31.9	...	1.07	1.30	.94
32-32.9	...	1.09	1.32	.96
33-33.9	...	1.11	1.34	.98
34-34.9	...	1.13	1.36	1.00
35-35.9	...	1.15	1.38	1.02
36-36.9	...	1.17	1.40	1.04
37-37.9	...	1.19	1.42	1.06
38-38.9	...	1.21	1.44	1.08
39-39.9	...	1.23	1.46	1.10
40 and above	...	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended December 15, 1945

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Distillate	Residual
East Coast	766	19,288	14,023	7,219
Appalachian	151	3,862	806	467
Ill., Ind., Ky.	727	17,702	5,890	2,843
Okla., Kan., Mo.	363	7,859	2,525	1,057
Inland Texas	201	2,742	413	819
Tex. Gulf Coast	1,097	15,333	6,130	4,727
La. Gulf Coast	298	4,156	1,912	1,520
North La., Ark.	61	1,783	511	335
Rocky Mtn.	123	1,828	501	699
California	775	14,480	8,257	23,276
Total 12-15-45	4,562	89,043	40,968	42,962
Total 12- 8-45	4,473	87,004	42,406	44,723
Total 12-16-44	4,576	82,996	41,759	59,118

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
December 15, 1945	219,518,000
December 8, 1945	218,355,000
December 16, 1944	222,075,000

*Excludes unrefinable California stocks.

PENBERTHY
"REFLEX"
WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

EIGHT interchangeable cutters. Fast cutting action, directed at 30 degree angle, cutters are hard surfaced steel. See Composite Catalog or write for Bulletin and additional information.

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2369 EAST 51st ST. · LOS ANGELES 11, CALIFORNIA
BRANCHES: HOUSTON, TEXAS · LAKE CHARLES, LA.
BAKERSFIELD, VENTURA AND AVENAL, CALIFORNIA

Among the

Drilling Contractors

Sterling Drilling Co. will drill a test for Plains Exploration Co. in SW SW SW 21-22-9w, in Reno County, Kansas.

Newell & Chandler of Calgary have spudded No. 2 test for Phillips Petroleum Co. (U.S.) on the Sullivan Creek structure in the southern Alberta foothills south and west of Turner Valley. Location is in LSD 3, 22-18-5w5.

Ralph M. Parsons Co., California drilling contractor, is preparing to drill a new well in the Cymric field for Independent Exploration Co. The new well, which will be spudded within another few days, will be drilled on the B. & J. property in Section 24-30s-29e.

Brown Drilling Co. is drilling a test for Standard of California at Pleasant Valley, Wash., just south of the British Columbia boundary.

Goodpasture Drilling Co. will drill two tests for Ed Swearer and associates, 1 Ross, SE SE NW 23-19-8w, in Rice County, Kansas, and 1 Witt, SW SW NE 1-23-13w, in Stafford County, Kansas.

Barnes & Shadrick have been awarded contract to drill another well for Cinnabar Exploration Co. in the north Mount Poso area where the company already has completed two tests. The new well will be drilled under contract in Section 17-26s-27e.

Fisher-McCall Oil & Gas, Inc., is the contractor for W. D. Gannett 1 Hood, NW SW SE 28-3s-14w, a wildcat in Van Buren County, Michigan.

Ike Taylor has the contract for H. H. Swartz, Jr. 1 Government, SW SE 22-13n-28e, 12 miles southwest of the Cat Creek field, Petroleum County, Montana.

Olson Drilling Co. is the contractor for a new Anadarko Basin test, Oklahoma Natural Gas Co. 1 Green, NW NW NW 6-17n-14w, in eastern Dewey County, Oklahoma.

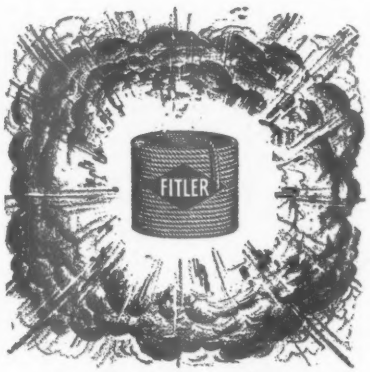
Goll, Graves & Mechling will drill Raymond M. White 1 Wojtas, SW SE SW 14-19n-4e, in the Deep River field of Arenac County, Michigan.

Sam Malis, Owensboro, Ky., will drill W. F. Lacy 1 Renkensmyer, SW SE NE 10-1s-2w, in Washington County, Illinois.

Shaffer Drilling Co. will drill Sohio Oil Co. 1 Ames, SW SW SE 25-18-11w, a wildcat in Barton County, Kansas.

Jim Collins is the contractor for Fred Riddell 1 Clark, NE SE NW 33-10n-7e, a wildcat in Tuscola County, Michigan.

Hayes Drilling Co. has the contract for four tests to be drilled in Gibson County, Indiana. They are Ryan Oil Co. 1 Nanney, SW SW SE



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27-1s-12w; Ryan Oil 2 Putnam, NW NW NW 26-1s-12w; Ryan Oil 5 Putnam, 990 ft. from the north and east lines of NE NE 27-1s-12w; and Ryan Oil 6 Putnam, 990 ft. from the north line and 330 ft. from the east line of NE NE 27-1s-12w. All are contracted to 2,400 ft.

Gordon Oil Co. has the contract for two Deep River tests in Arenac County, Michigan. The tests are Raymond W. White 2 Wojtas, SE SE SW 14-19n-4e, and Fletcher & Leman 5 Smith, SE SE SE 15-19n-4e.

Luther McIntosh, Petersburg, Ind., will drill Sam R. Travis et al 1 Walker, 605 ft. from the north line and 720 ft. from the west line of NW SE 22-1n-9w, in Pike County, Indiana.

Hagen & Hagen will drill Sterling Oil & Gas Producers Co. 1 Toodzio, NW NE SE 13-8n-16e, a wildcat in St. Clair County, Michigan.

Muskegon Development Co. will drill two Bay County, Michigan, tests: Gulf Refining Co. 1 Fritsch, SW NW SW 15-14n-6e, in the Essexville field, and Gulf Refining Co. 2 Richer, N/2 SW SW 33-15n-4e, in the Kawkawlin field.

Brunson Drilling Co. is the contractor for Fred Anschutz 1 Webb, NE NE NW 21-7-26w, Sheridan County, Kansas.

Jim Collin is the contractor for Frank R. Schrot 1 Reed, SW NW SE 11-14n-2w, in the East Greendale field of Midland County, Michigan.

Ajax Drilling Co. has the contract for Ashby Drilling Co. 1 Sengelaub, NW SE SE 19-17n-10w, a wildcat in Osceola County, Michigan.

Veeder Supply Co. will drill McLaughlin et al 1 Gravestein, NW NW NW 21-8-6e, a wildcat in Riley County, Kansas.

Max Spidel will drill the Q. Devries 1 Naber, NW NE SE 35-5n-15w, in the Zeeland field of Ottawa County, Michigan.

Standard of California Starts San Joaquin Line

Construction has started for Standard Oil Co. of California on the 175-mile crude-oil line from San Joaquin Valley to San Francisco, Calif., to cost $3,000,000, which will have a daily capacity of 90,000 bbl. Laying of the line has been contracted by Bechtel Brothers-McCone Co.

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Designed to lighten and speed up the job of running tubing, BJ type "T" tongs are equally valuable in "nippling up" or as lay tongs. Made in five series: A, B, C, D, and E, with available jaws in each series to handle API tubing and coupling sizes from 1" to 4", plain or upset.

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PERSONALS

Heads Company Year After Its Organization

LOREN F. KAHLE, who last week was named president of Interstate Oil Pipe Line Co., Tulsa, came to Tulsa in 1943 to join the staff of The Carter Oil Co. as superintendent of petroleum transportation, following 19 years of engineering and production experience in the oil fields of Mexico and Venezuela with other subsidiaries of Standard Oil Co. (N.J.).

Kahle's recent promotion elevated him from his previous office as executive vice president of the company, which post he has occupied since the company's reorganization a year ago.

Kahle joined Standard Oil in 1924, when he became a laborer in the manufacturing branch of the organization at Bayway, N. J. A year later he was transferred to Standard Oil Development Co.'s department of engineering training and was sent to Tampico, Mexico, as engineer for Cia. Transcontinental de Petroleo. In 1927 he was promoted to assistant chief engineer, and in 1929 to chief engineer.

Six years later Kahle transferred to Caripito, Venezuela, as chief engineer for Standard Oil Co. of Venezuela, where he remained until December 1941, when he became operating head of the company's Caripito terminal.

Kahle was born in Toronto, Canada, December 31, 1903, and was raised in Oklahoma. He received his university education at Iowa State College, from which he was graduated in 1924 as bachelor of science in mechanical engineering.

Lt. Col. John F. Younger who recently completed 4½ years in the military service, including 2½ years overseas, has joined the Western Co., an acidizing company in the West Texas Permian Basin.

H. M. Arveson has been appointed senior technologist in the recently formed chemical products department of Standard Oil Co. (Indiana). He joined the company in 1927 as a research chemist at Whiting refinery laboratories. He is current chairman of the Chicago section, American Chemical Society.

Robert R. Wason, president of Manning, Maxwell and Moore, Inc., New York, was elected president of the National Association of Manufacturers recently at the Golden Anniversary Congress of American Industry. Wason is also chairman of the association's Reconversion Council and a director.

James E. Moss, Philadelphia, has been appointed director of the Division of Transportation of the American Petroleum Institute. Moss was operations manager of the marine department of the Atlantic Refining Co. for many years, and was active on the institute's committee on rules for tank vessels.

Dr. L. W. Parsons, for the past 4 years Washington representative for Tide Water Associated Oil Co., has been named export sales manager for Tide Water's eastern division. He has had wide experience in manufacturing, sales and research. Before the war, he was head of the company's sales engineering for the eastern division's wholesale, export and industrial products departments, and prior to that was chief technologist in charge of research and development.

Jack Stewart, of Arcadia, Calif., who was in charge of the drilling of the first deep wells in the Rangely and Wilson Creek fields in Colorado for the Richmond Petroleum Co., the first in 1918 and the second in 1921, has returned to Rangely and purchased property preliminary to entering business. Both of the earlier wells failed to go deep enough with cable tools. Both fields subsequently came in as producers.

Joseph A. Minton, of Kemmerer, Wyo., has resigned as general manager of the Western Oil Refining Co. following the sale of his stock holdings to **Patrick J. Quealy,** president of the company, and that corporation and the P. & Q. Co. have been merged with Carl Praff as production manager.

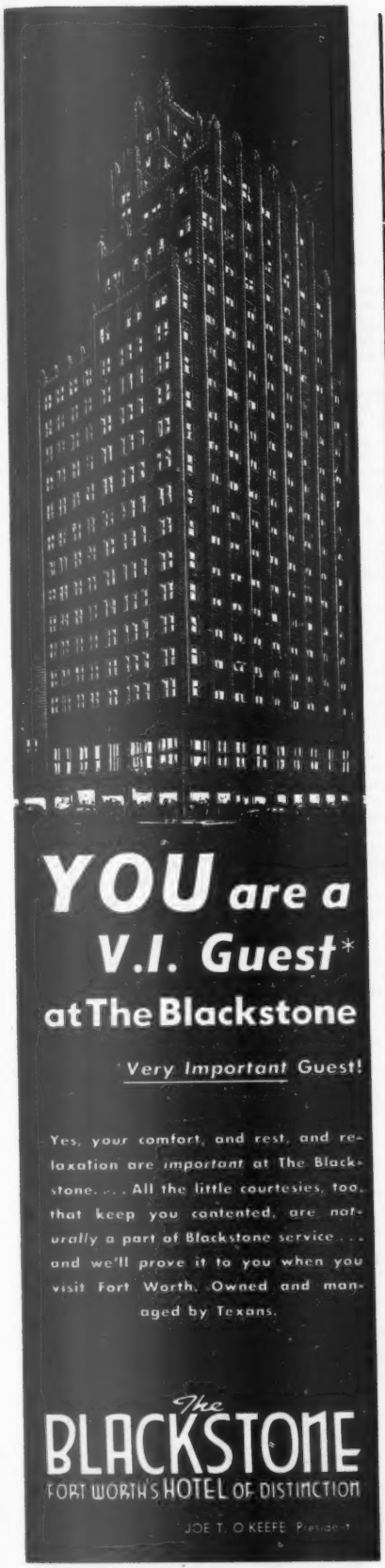
W. H. Ferguson, executive vice president, and **J. A. Lantz, W. B. Elliott** and **T. C. Johnston,** of the Continental Oil Co. staff in Denver, have returned from a company meeting at President Dan Moran's ranch near San Antonio, Tex.

R. S. Shannon, of Denver, and associates, have sold their stock in the Unit Oil Corp. to the Sinclair-Wyoming Oil Co. The Unit company owned approximately 15 per cent interest in the Tensleep horizon unit in the Big Sand Draw field, Wyoming, covering approximately 1,780 acres.

E. J. McCurdy, Jr., Fort Worth, has been elected president of the East Texas Oil Association. **C. J. Wrightsman,** also of Fort Worth, was elected a vice president along with **Grady Vaughn, J. C. Hawkins, R. W. Fair, W. M. Priddy, E. C. Johnson** and **Roy H. Laird. H. P. Nichols** of Tyler was reelected as executive vice president with **E. Holiman,** secretary-treasurer.

H. G. M. Fischer and **Edwin J. Gohr,** formerly manager and associate manager of divisions of the Esso Laboratories, have been appointed assistant managers of the Research and Development Department of Standard Oil Development Co. They will share responsibility for new and improved processes in the petroleum field.

Winthrop P. Clark, Saginaw, Mich., manager of Gulf Refining Co.'s land division, has been elected president of the Michigan Oil and Gas Association. Directors also decided to move headquarters of the association from Grand Rapids, where it has been since 1940, back to Mount Pleasant, nearer the cen-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ter of current oil and gas operations.

C. L. Larson has been made division geologist for the Texas-Louisiana Gulf Coast division of Stanolind Oil & Gas Co., with offices at Houston. Other appointments are: **Russell Farmer,** division geologist of the North Texas-New Mexico division, at Fort Worth; **W. C. Imbt,** district geologist for the West Texas-New Mexico district, at Midland, Tex.; **E. L. Reed,** district geologist of the North Central Texas district, at Wichita Falls, Tex.; **C. R. Canfield,** assistant division geologist for the central division, at Tulsa; **T. G. Wright,** district geologist of the Kansas district, at Wichita, Kans.

Warren J. Jackson, Lane-Wells Co., was elected president of the Dallas Petroleum Engineers Club, succeeding **Charles B. Carpenter** of U. S. Bureau of Mines. Other officers elected are: **K. Marshall Fagin,** Petroleum Engineers Magazine, vice president in charge of programs; **J. Walter Black,** Magnolia Petroleum Co., vice president in charge of arrangements; **Dewey A. Jordan,** Atlantic Refining Co., vice president in charge of membership; and **R. U. Maddox,** Big West Drilling Co., secretary-treasurer.

R. B. Smith, just out of the Navy, is now scouting the Ardmore, Okla., district for Superior Oil Co. of California, and **B. B. Barber,** also just out of service, is scouting the same district for Tide Water Associated Oil Co.

Chester R. Rogers has been promoted to district superintendent of Lone Star Producing Co. and Lone Star Gas Co.'s gasoline and cycling plants in the East Texas area. **J. A. Bates** has been named superintendent of Lone Star gasoline plants in the West Texas area, succeeding Rogers. Bates, who will have headquarters in Ranger, Tex., is succeeded by **W. A. Robinson** as assistant superintendent of the West Texas plants. **Ted R. Sparling** has been named superintendent of Lone Star's gasoline plant at Trinidad, Tex. **Roy Helm,** Hollis, Okla., replaces Sparling as assistant superintendent of the company's cycling plant at Grapeland, Tex. **Lonnie C. Stephens** has returned from military service to his former position as assistant superintendent at the Hollis gasoline plant, replacing Helm.

C. E. Chesher, formerly in charge of geophysical work in the West for Shell Oil Co., Inc., will head the new Canadian Exploration Co., with headquarters at Calgary, the first Canadian organization to undertake geophysical work. The first surveys will be started in the Alberta foothills in January.

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Equipment Men in News

C. B. Phillips, vice president of Surface Combustion Corp., Toledo, Ohio, announces the appointment of **George D. Yeazel** factory sales representative at Kansas City, Mo., with offices at 950 Dinks Building, of which **Wallace Adams** is district manager.

R. R. Robinson has been named assistant chief engineer in charge of engine design at Caterpillar Tractor Co. according to **C. E. Burks,** chief engineer.

An expansion program for The Happy Co. was drafted at the annual sales meeting held in Tulsa November 26 to 28, which celebrated the firm's twenty-fifth anniversary, according to **Paul E. Mahaffey,** president. Those employes with long service include **Roy Lindley,** secretary-treasurer, 21½ years; **Leo King,** vice president and sales manager, 21 years, and **Bob Meek,** sales engineer, 13 years. The expansion program was developed to provide greater service to the industry, Mahaffey pointed out. "This is our twenty-fifth anniversary year and represents the company's highest volume sales record to date. This indicates the confidence built up by the personnel of the company over a long period of years and forecasts even greater service to petroleum operators in the years ahead."

Gordon P. Street has been elected president of The Wheland Co. of Chattanooga, Tenn. The Wheland organization will continue intact, with **E. F. Wheland** serving as chairman of the board, **Charles W. Wheland,** vice president, **O. L. Martin,** secretary, **George Campbell,** chief engineer, and **Ralph E. Shafer,** sales manager.

David L. Gordon and **W. C. Hildebrand, Jr.,** are associating with the Anchor Petroleum Co. of Tulsa, to form Anchor Oil Co., according to **W. A. Baden,** vice president. The company, with offices in Houston, Tex., will handle world-wide distribution of all petroleum products, including liquefied petroleum gas. Their plan of operation, in addition to domestic shipping, will include coastwise and export shipping to Europe, Asia, and all South American countries.

Bovaird Supply Co. held its annual sales and stockholders meeting in Tulsa November 26. It was attended by all store managers and district managers, all of whom are both stockholders as well as sales representatives of the company. All directors and officers were elected for the coming years. Officers elected are **W. M. Bovaird,** president; **F. D. Bovaird,** vice president; **D. D. Bovaird,** vice president and treasurer; **R. M. McMahan,** secretary and assistant treasurer; **D. M. Bradley,** vice president, and **G. V. Douglas,** assistant secretary.

Carboloy Company, Inc., Detroit, announces establishment of a new southwestern district and appointment of **A. J. Rod,** sales engineer in charge of the Houston branch, as district manager. The new district consists of territory in northern Texas, New Mexico, Oklahoma, Kansas, Louisiana, Arkansas, Alabama, Mississippi and western Florida currently assigned to the Houston branch and authorized dealers in El Paso, Dallas, New Orleans, and Tulsa.

G. P. STREET

W. C. HILDEBRAND

D. L. GORDON

Graff Engineering & Equipment Co., 505 South Third Street, Louisville, Ky., has been formed by **Robert A. Graff,** owner and manager. This company will engage in general gas engineering, offering specialized service in the field of gas production, purification and dehydration equipment.

M. J. (Whitey) Crose has recently joined the Perrault Brothers organization in Tulsa as general superintendent of equipment. He came from the staff of Crutcher-Rolfs-Cummings with which he had been connected for 11 years. Prior to that connection Crose had wide experience in supervising dope gangs in the United States and South America for pipe-line construction contractors.

Addition of **H. T. Brettelle** to the Detroit staff of Grant Advertising, Inc., as an account executive, is announced. Before joining the Grant organization, Brettelle was with Detroit Diesel Engine division of General Motors.

International Harvester Co. has announced the following changes in branch management personnel: **C. A. Samuelson,** formerly branch manager, Minneapolis, Minn., motor truck branch, has been named manager of the motor truck branch at St. Louis, Mo. He succeeds **J. W. Blackmore** who has taken over an International Harvester dealership. **S. A. Hayes,** manager at the Seattle, Wash., motor truck branch until the outbreak of the war, has been appointed manager of the Minneapolis motor truck branch succeeding Samuelson. **E. N. Black, Sr.,** formerly branch manager at Cheyenne, Wyo., is now manager of the company's Springfield, Mo., branch. **G. C. Murnan,** formerly assistant manager, Portland, Ore., general line branch. has been made branch manager at Cheyenne, Wyo., succeeding Black. **W. G. Schendel,** formerly assistant manager at Pittsburgh motor truck branch, has been appointed assistant manager of the Harrisburg, Pa., motor truck branch. **G. D. McCarthy** has returned to his previous Harvester position as assistant manager of the Philadelphia motor truck branch. **E. E. Krogstad** returns as assistant manager of the Tulsa motor truck branch. **W. O. Bolitho,** formerly assistant manager of the Cheyenne, Wyo., branch, becomes assistant manager at the Billings. Mont., branch. **W. C. Habert,** formerly assistant manager at the Elmira, N. Y., branch, has assumed the same position in the West Haven, Conn., motor truck branch. **Wayne Greene** has been appointed assistant manager at the New Orleans, La., motor truck branch.

Comdr. George Gellhorn, who left Worthington Pump and Machinery Corp. on January 1, 1942, for active duty in the U.S. Navy, has been released to inactive status and has returned to resume his position as export manager with offices at Worthington's Harrison Works.

Appointment of **C. J. Bickler** as manager of sales of Globe Steel Tubes Co.'s Los Angeles office has been announced by **F. J. O'Brien,** vice president in charge of sales. Bickler has served as assistant to the vice president in charge of sales with headquarters in the general sales office at Milwaukee for the past 3 years.

H. "Red" Gottwald (left in photo), for 17 years a service engineer for Pittsburgh Equitable Meter Co.-Nordstrom Valve Co. in the metropolitan New York territory, has been assigned to the Rockwell International Corp. Gottwald has been appointed special representative for Latin America by **A. L. DiGiulian** (right in photo), vice president and general manager of the export firm. He is now making a preliminary trip covering the important markets in South America.

HELP WANTED

WANTED: Administrative assistant familiar with oil field drilling and production operations and materials and office procedures to assist in cooperative work. Graduate engineer preferred but not necessary. Give complete history of previous and present work and salaries received and expected, with references. All replies will be kept confidential. Address Box A-895, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Graduate Mechanical Engineer having at least 6 to 10 years refinery experience, design, maintenance and construction. Box A-901, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Expert cementer of oil and gas wells. Monthly salary plus expenses. Steady job for sober and dependable man. Standard Cementing & Mudding Co., 110 Federal Square Bldg., Grand Rapids 2, Michigan.

WANTED: By The Superior Oil Company, young men with college background in electronics. Single men preferred. Write P. O Box 96, Bakersfield, California. Apply 1425 Union Ave., Bakersfield, California.

WANTED: By The Superior Oil Company, young men with college background in geology. Single men preferred. Write P. O. Box 96, Bakersfield, California. Apply 1425 Union Ave., Bakersfield, California.

INSTRUMENT ENGINEER technically trained to take charge of layout, installation, and maintenance of instruments in petroleum refinery. Chicago district. Box A-916, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Manager for construction division to take full charge. Executive with ability to organize and get results. Must be experienced with oil refineries, chemical, steel construction, etc. Write stating age, education, experience, references and salary expected. Box A-813, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Experienced Core Drillers. Steady work and good wages. Bury & Clemens Exploration Co., Box 316, Princeton, Indiana.

WANTED: Draftsman, preferable experienced in drafting maps for Land, Production, and Geological Departments of an oil company. Give employment history and salary expected. Box A-927, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Experienced large steel oil storage tank salesman. Salary and large selling commission. Box A-928, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: MINING OR PETROLEUM ENGINEER by Major Oil Company. Recent graduate or with some experience, for Exploitation and Production Engineering work. Training course if inexperienced. Write Box A-799, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: MECHANICAL ENGINEER. Major Oil Company requires graduate Mechanical Engineer for Production Department. Either experienced or inexperienced. Write Box A-800, The Oil and Gas Journal, Tulsa, Oklahoma.

OPPORTUNITY AVAILABLE

Engineering Firm needs services of capable sales engineer to manage Tulsa Office Territory. Age thirty-five to forty-five with sales experience in process equipment field and engineered contract work. Give full details of experience. Address Box A-929, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

Ex-Navy Lt. with degree in petroleum engineering desires work with oil company in Mid-Continent or Gulf Coast areas. Box A-918, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER. Age 35. Sales, Production and Executive experience. Wide acquaintance in Texas, N. Mex., and Okla. Desires connection as manufacturers agent, sales, or as production engineer. Availabe Jan. 15. Box A-921, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

EX-NAVAL AVIATOR, age 27, University of Notre Dame graduate, licensed commercial pilot; desires position with person or corporation, preferably as pilot and executive assistant. Ambitious, reliable. Excellent references. South America considered. Box A-900, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED REFINERY construction and operator desires position in small progressive refinery with option to purchase interest. Box A-904, The Oil and Gas Journal, Tulsa, Oklahoma.

PURCHASING AGENT desires permanent position with major or well established independent company. Thoroughly experienced in purchasing organization, procedure, handling people, assuming responsibilities, and very familiar with machine tools. Age 29, University, and now employed as Purchasing Agent by large Industrial and Mill Supply Co. Available two weeks. Salary $350.00. Box A-906, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT: Thirty years' experience in construction and operating skimming, cracking, polymerization units; also gasoline plants. Would like to make connection with independent company in southwest. Can furnish best of references. Available January 1st. Box A-914, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE — Construction Supersisor: Graduate Mechanical Engineer, 10 years experience, complete refinery, in maintenance-construction and as administrative assistant. Married; 35; children. Correspondence confidential. Minimum $6,500. For enthusiastic viewpoint, ability to plan imaginatively, to organize, get along with and direct people, contact Box A-894, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER. Production and Sales Experience. Wide aquaintance in Southwest, wishes to buy interest in small concern. Marketing, manufacturing, or production. Box A-920, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Maintenance or construction work. Background: B.S. degree—mechanical engineering. Five years oil refinery experience. Box A-923, The Oil and Gas Journal, Tulsa, Oklahoma.

DISCHARGED ARMY PILOT, BA Degree, 28, married, 2300 hours flying time, commercial and instrument rating, desires flying job domestic or foreign. M. N. Myrick, 1123 7th Ave., Ft. Worth, Texas.

IN PETROLEUM TESTING laboratory. 9 years' experience engine testing in research and refining laboratories. CFR knock engine operator capable of operating, maintaining and supervising all test methods. Excellent references. Available immediately. Box A-912, The Oil and Gas Journal, Tulsa, Oklahoma.

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Rubber Supply, Price to Be Discussed Next Month

WASHINGTON.—Public hearings on the supply and price for synthetic and natural rubber will be held in Washington January 8, 9 and 10 by the Inter-Agency Policy Committee on Rubber, of which William L. Batt is chairman. Following these hearings, the committee will report to the Office of War Mobilization and Reconversion on the adequacy of proposed rubber programs and make recommendations on phases of a national policy for rubber.

Hearings will be open to all who wish to be heard. Testimony and briefs must be confined to the subjects within the functions of the committee. These are: (1) To obtain and assemble information on short- and long-term rubber requirements and supply, and on production costs of synthetic rubber and related subjects; (2) to survey plans of government agencies for the maintenance of a synthetic-rubber industry, plans for stand-by rubber plants and disposal of surplus plants. Plans for encouragement of research and development, stockpiling of rubber, development of Western Hemisphere sources and imports from the Far East.

Members of the industry who wish to be heard or to file briefs with the committee have been asked to communicate with Howard S. Piquet, executive secretary, Room 4737, Social Security Building, Fourth and Independence Avenue, S. W., Washington, D. C.

Magnolia Builds Midland Office

MIDLAND, Tex.—Construction will be started soon here by Magnolia Petroleum Co. on a two-story-and-basement building to house the offices of the company's Permian Basin land, geological and production departments, and the division offices of Magnolia Pipe Line Co.

Construction will be of brick, tile and concrete. The structure will be air conditioned.

Sohio-Fleetwing Formed to Handle Fuel-Oil Business

CLEVELAND. — Sohio-Fleetwing, Inc., has been organized as a wholly owned subsidiary of Standard Oil Co. (Ohio) to take over the domestic fuel-oil business purchased recently from Fuel Oil Corp. which operated in Greater Detroit. Standard (Ohio) formerly held a substantial interest in the Detroit company.

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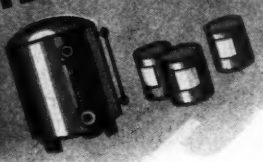

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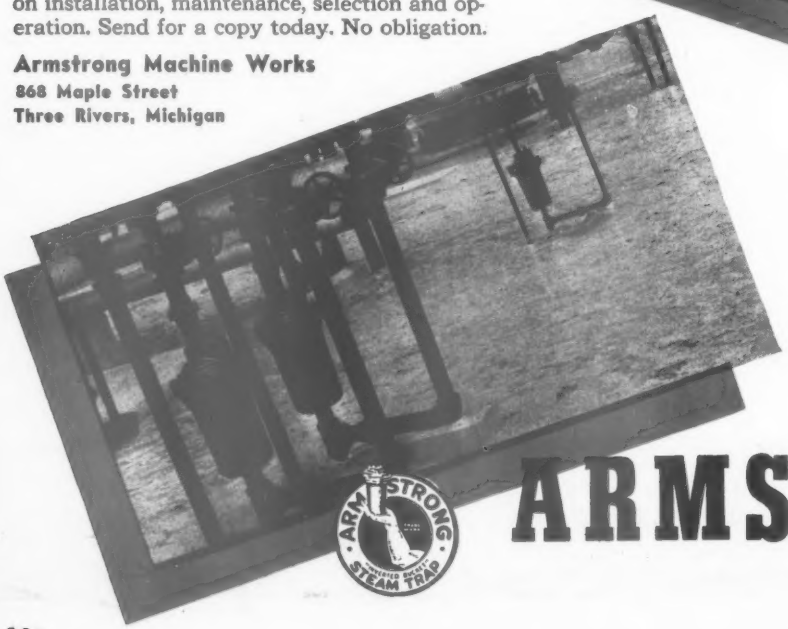

Above — Forged steel trap on a reboiler at a natural gasoline plant.

Left — Standard bottom-inlet, top-outlet traps draining heat exchangers and reboilers at a recycling plant.

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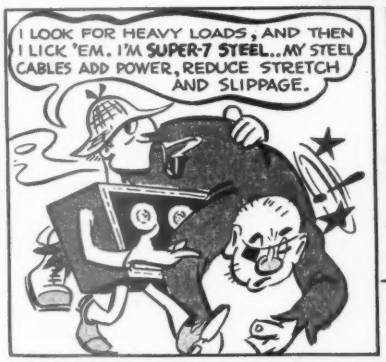

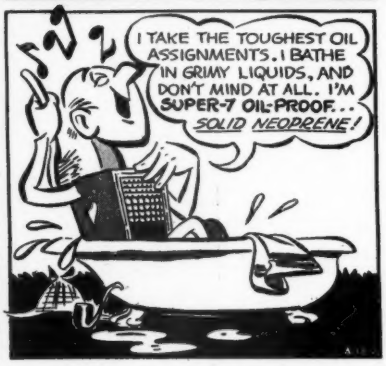

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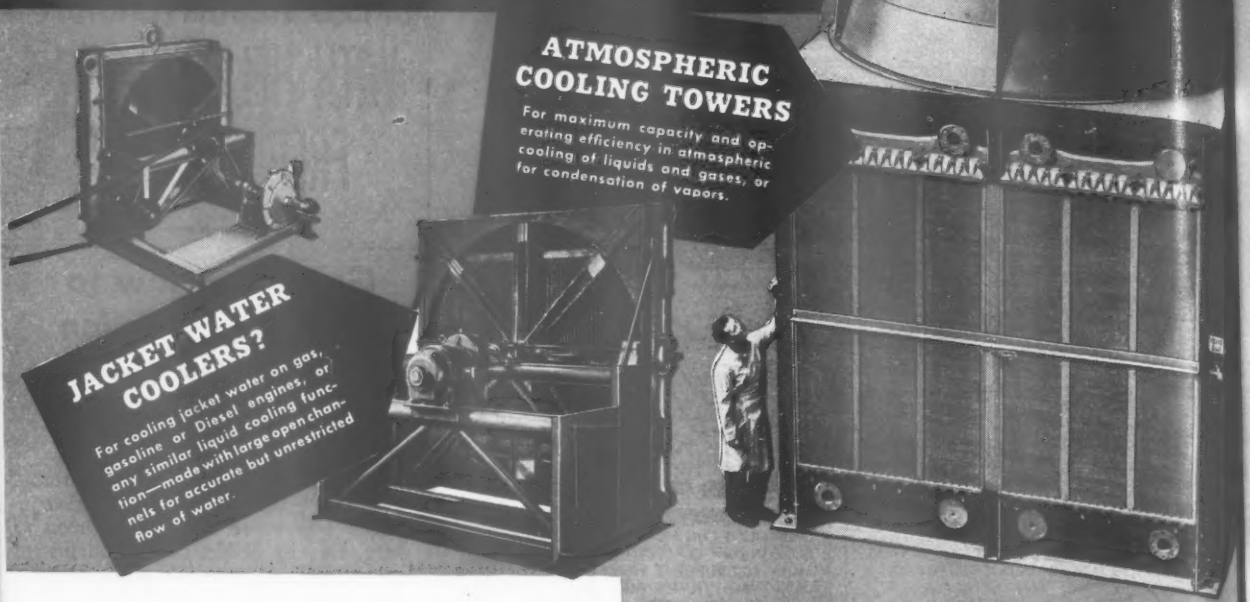

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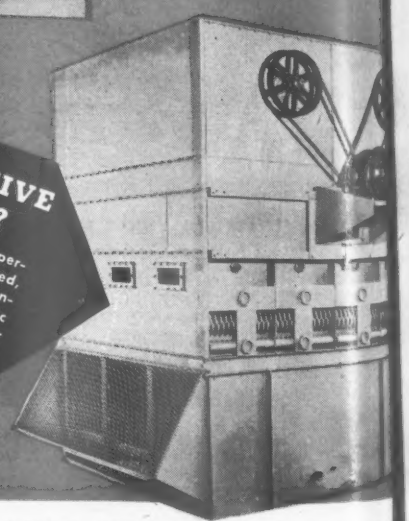

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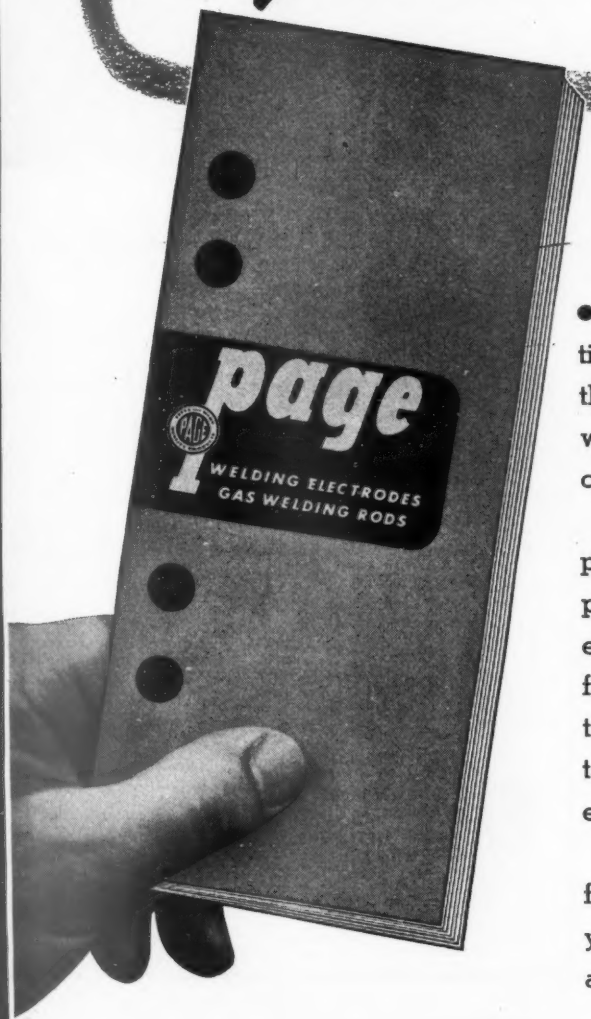

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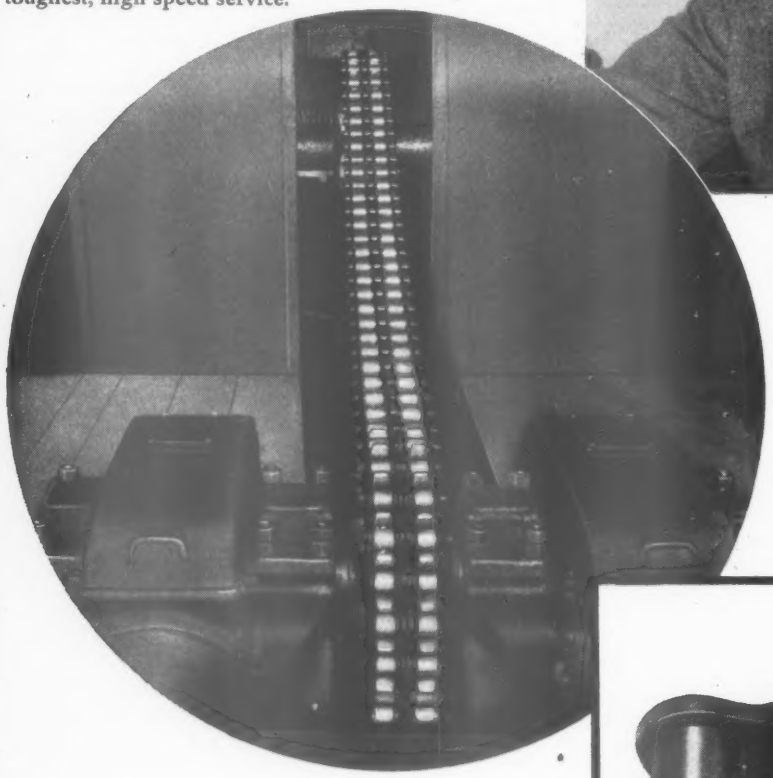
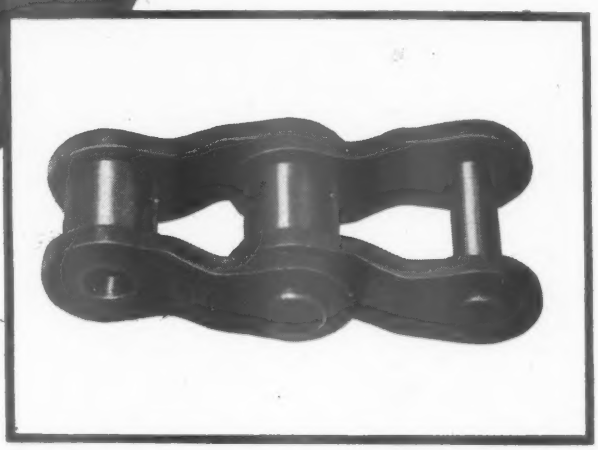


② ON THIS DRAW WORKS, for example, Rex 3125, with its shorter pitch and higher ultimate strength, is used for fast deepwell drilling. Available, in a single strand, with an ultimate strength of 115,000 pounds, or in double strand, with an ultimate strength of 230,000 pounds, Rex 3125 has the ability to handle the heaviest loads of modern deepwell service. It is sturdily built of highest quality steels with alloy steel bushings, case hardened and ground inside and out for extreme hardness, toughness.



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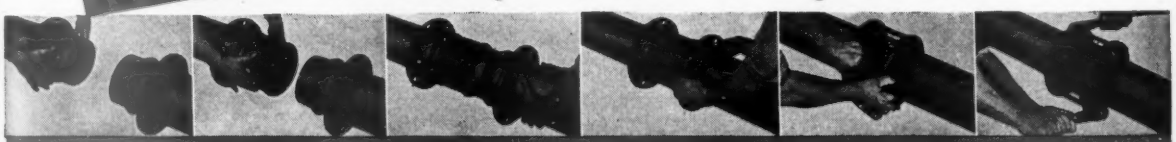

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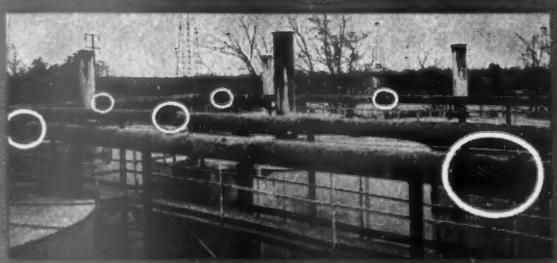

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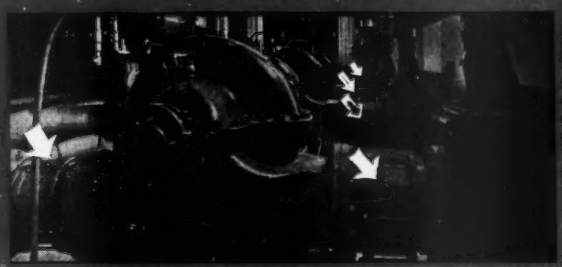

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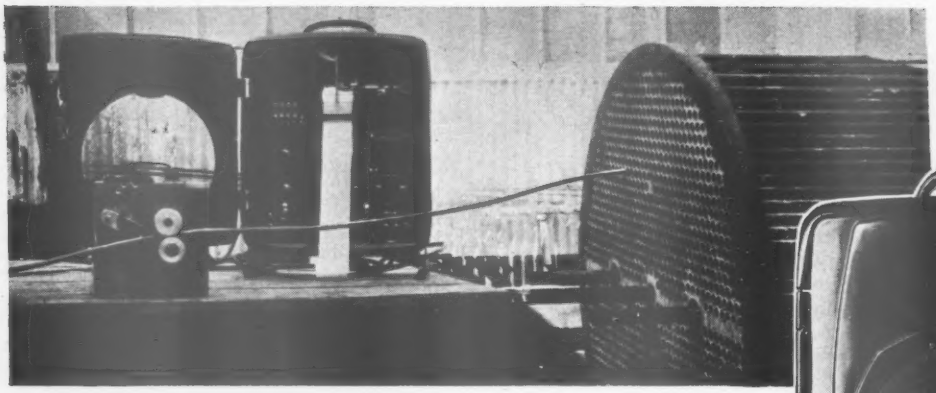
ONE OF THE DRESSER INDUSTRIES

for Plain-End Pipe



Probolog in use inspecting tube bundle. Picture shows probe in tube, probe puller withdrawing probe at constant rate, and recording instrument charting internal tube condition.

HERE'S A NEW WAY TO LOOK FOR TROUBLE!

THE PROBOLOG is an inspection device for testing non-magnetic tubes *without removing them from the equipment in which they are installed.*

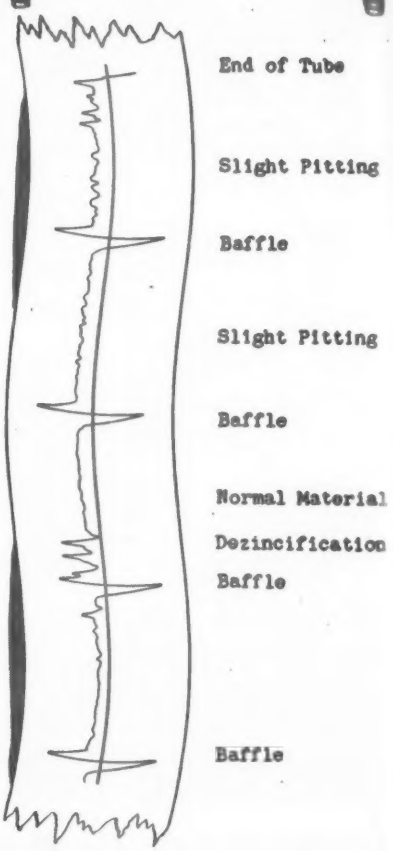
By using the device, it is possible not only to locate *quickly and accurately,* faulty, inaccessible tubes in heat exchangers, condensers and similar tubular equipment, but to obtain a graphic record of the defects as well.

How the Probolog works: A probe is pushed or pulled through a tube by a cable. As it moves through the tube, the recorder charts or flashes the position of each defect in the tube.

The Probolog detects dezincification, eroded and corroded pits, cracks, strained areas, increases or decreases in wall thickness, changes in alloy or chemical composition and abnormal changes in physical dimensions —a complete record in black and white.

The Probolog saves time and material. Dismantling and reassembling equipment is eliminated. Only defective tubes need be removed, and these may be reclaimed and salvaged.

Write for further particulars



Actual graph of defective isobutane condenser tube.

SHELL

SHELL DEVELOPMENT COMPANY, INCORPORATED

50 West 50th Street, New York 20, N. Y.

THERE'S A SIZE FOR EVERY JOB

Unit pictured is the A-80-TC with a structure rating of 7,500 API pounds. Three other sizes, two larger and one smaller, are also available. Prime mover may be electric motor, single or multi-cylinder gas or gasoline engine.

Self-contained, unit-type skid base makes field transportation and installation easy; gives maximum strength with minimum weight; eliminates necessity of expensive foundation.

Weatherproof construction minimizes need for housing. Helical gearing and Timken-equipped, double reduction reducer provides high mechanical efficiency. Has Shafer self-aligning roller bearings on wrist pin and equalizer. Arc-type hanger gives straight polished rod lift and permits tipping back for servicing.

Effective balancing obtained with master and auxiliary crank weights. Stroke lengths and pumping speeds are adjustable. All bearings and working parts easily accessible for inspection and lubrication. Reliable brake stops and holds load in any position.

A-80-TC Specifications

Unit Structure Rating, API, pounds	7,500
Unit Gear Peak Torque Rating, API, inch pound	44,550
Reduction Unit Ratio	28.4:1
Range of Polished Rod Strokes, inches	22"—26" 30"—36"
Maximum Counterweight Effect at Maximum Polished Rod Stroke, pounds	4,523
Pitch Diameter of V Belt Sheave	16.6"—4B
Walking Beam Size and Weight	12"—28lb.CB
Well End Working Centers, inches	48
Weight of Master Crank Weights per pair, pounds	310
Weight of Auxiliary Crank Weights per pair, pounds	220
Weight of Beam Weights each, pounds	120
Total Weight of Unit, less Beam Weights and Engine, pounds	3,530

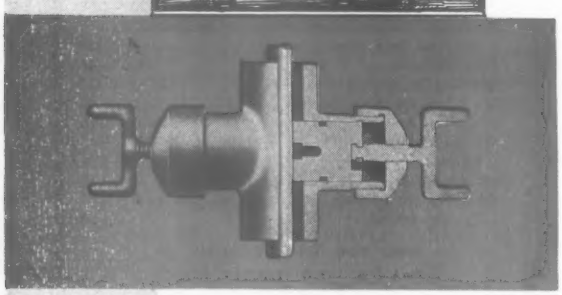
SEND FOR SPECIFICATIONS OF SMALLER AND LARGER UNITS

ALTEN'S
FOUNDRY AND MACHINE WORKS
Established 1889 LANCASTER, OHIO
Write Us Direct for Catalogue
Leading Supply Stores Carry All Alten Oil Field Equipment

ADJUSTABLE RETRACTABLE RUBBERS

Prolongs life of . . .

The "Double E" Adjustable Sucker Rod Stripper is the most economical and practical tool of its type. It not only does an excellent job of cleaning oil and paraffin from sucker rods as they are being pulled, but it has the very fine advantage of having retractable rubbers which can be withdrawn into the housing when not needed for stripping. This permits a long rubber life and also permits adjusting the rubbers against the rods to compensate for normal wear. The packing elements are of soft rubber (two halves) and readily accommodate any size rod or coupling. An examination of the cut shows how the packing is screwed against or backed away from the rods.



"DOUBLE E" BLOWOUT PREVENTER

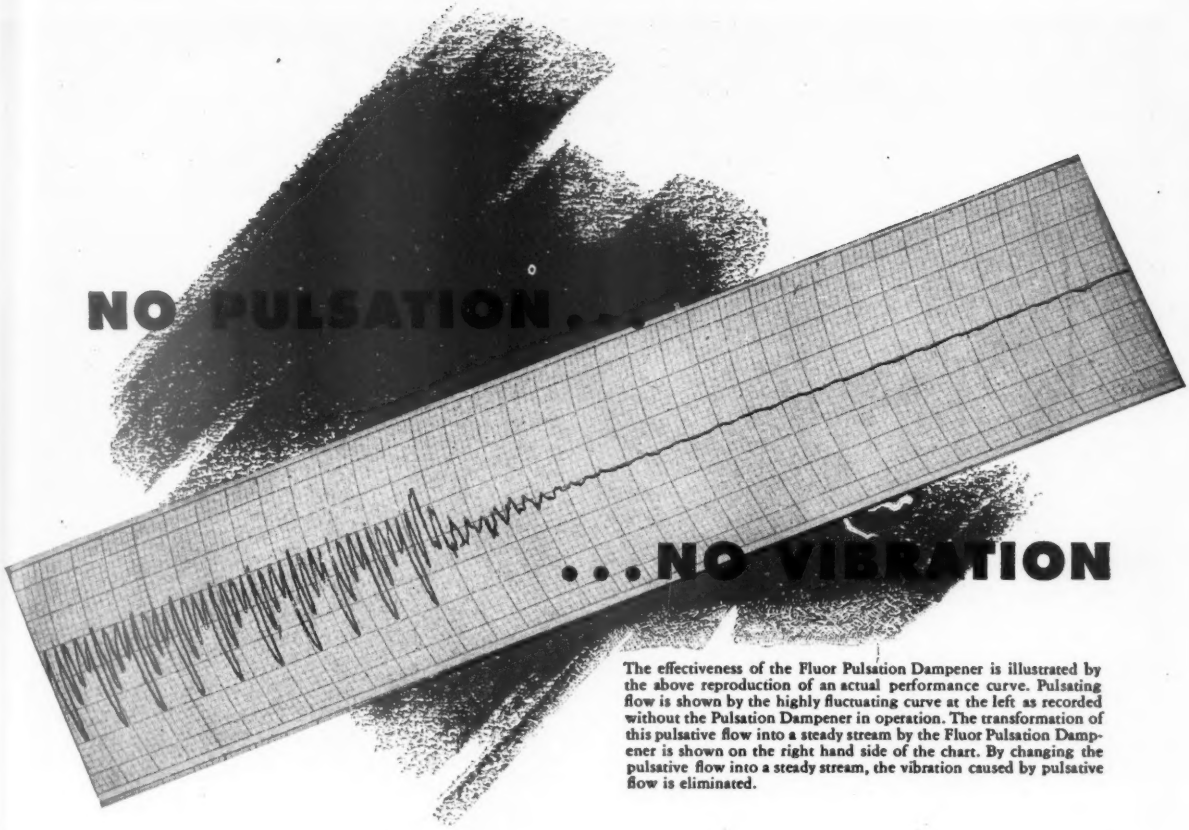
The "Double E" Blowout Preventer for sucker or polished rods works on the same principle as the stripper but is constructed somewhat differently. Instead of the soft rubber packing, cylindrical steel rams are used, to which has been molded a fabric reinforced sealing element. This oil resistant synthetic rubber element backed by the steel ram prevents leakage against high pressure.

The use of the Blowout Preventer in conjunction with the Sucker Rod Stripper provides ideal protection against handling wet rods and pressure surges in heading wells.

"DOUBLE E" Products

2039 AMELIA STREET
DALLAS 9, TEXAS

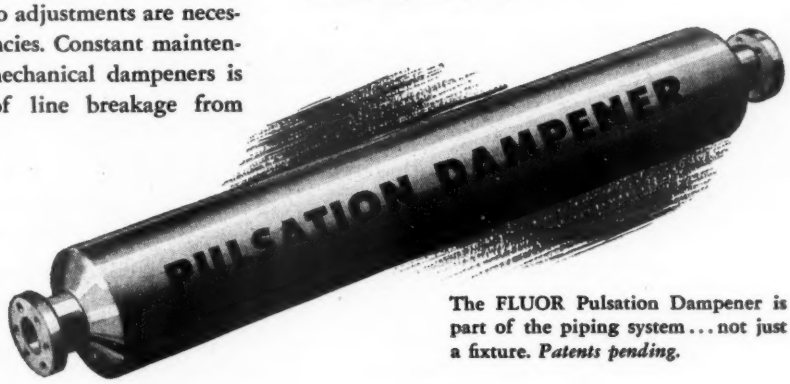
EQUIPMENT ENGINEERS
INCORPORATED



The effectiveness of the Fluor Pulsation Dampener is illustrated by the above reproduction of an actual performance curve. Pulsating flow is shown by the highly fluctuating curve at the left as recorded without the Pulsation Dampener in operation. The transformation of this pulsative flow into a steady stream by the Fluor Pulsation Dampener is shown on the right hand side of the chart. By changing the pulsative flow into a steady stream, the vibration caused by pulsative flow is eliminated.

THE FLUOR PULSATION DAMPENER smooths pulsative flow into a steady stream in pipe lines carrying air, vapors or gases... regardless of engine speed, pressure or rate of flow. Designed for the *lowest* operating speed, it works even more efficiently as speeds are *increased*. No adjustments are necessary for higher frequencies. Constant maintenance necessary with mechanical dampeners is eliminated. Danger of line breakage from vibration is removed.

You can save on labor, materials and maintenance by specifying the FLUOR Pulsation Dampener on all new installations... and by installing it in your present lines where vibration is a constant problem and expense. Write for descriptive bulletin.



The FLUOR Pulsation Dampener is part of the piping system... not just a fixture. *Patents pending.*

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Solar Exhaust Manifold *"In Action"*

THE ABOVE PHOTOGRAPH, taken in complete darkness without artificial lighting, dramatically shows the intense heat Solar airplane exhaust manifolds experience in service. This punishment goes on hour after hour for thousands of hours—a striking testimony to Solar workmanship.

During the past 15 years, Solar has fabricated over 300,000 engine sets of airplane exhaust equipment representing more than 1000 designs. The "know-how" gained extends over all stainless steel forming techniques from deep drawing to precision casting.

If your problem is manufacturing heat or corrosion resistant products from stainless steel or other high temperature alloys, consult Solar. Wire or write for helpful information.

ARMY ★ E ★ NAVY
ARMY ★★ E ★★ NAVY

SOLAR

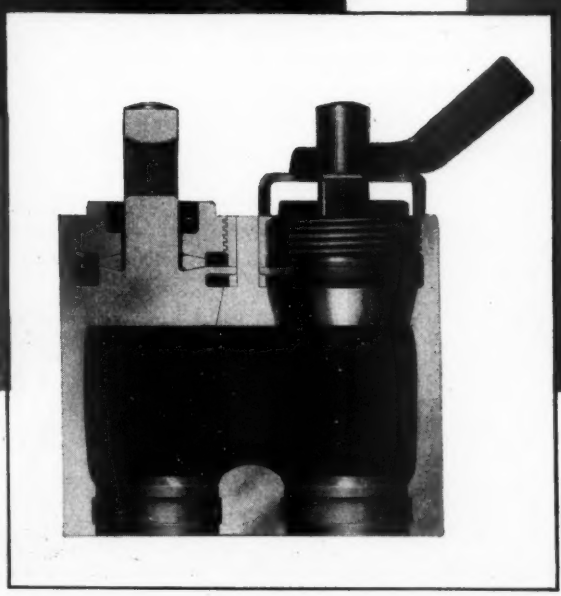
STAINLESS STEEL PRODUCTS

SOLAR AIRCRAFT COMPANY ★ SAN DIEGO 12, CALIF. ★ DES MOINES 5, IA.

From the inside out . . .

IT'S NEW IT'S QUALITY IT'S OHIO

The OHIO Type 1640



The new Ohio Type 1640 Return Bend has the strongest top construction in use today! With this feature the 1640 has already earned a higher pressure-temperature rating than any other type of fitting. Write for details about this and the many other advantages of the new Ohio Type 1640.

The OHIO STEEL FOUNDRY CO.

SPRINGFIELD, OHIO • Plants in Lima and Springfield, Ohio

ENGINEERS • FOUNDERS • MACHINISTS

FREE ENTERPRISE IS THE ONLY WAY TO CONSTANTLY HIGHER AMERICAN LIVING STANDARDS

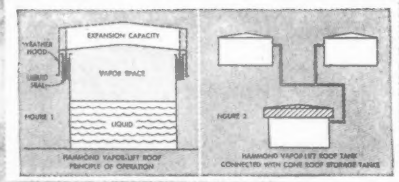
HAMMOND *Vapor-Lift* TANK ROOFS

STOP *Breathing Losses*

REDUCE FILLING LOSSES

PRESERVE PRODUCT QUALITY

HAMMOND VAPOR-LIFT ROOF TANKS provide a variable vapor space, of ample capacity, to permit the expansion or contraction of vapors thus eliminating breathing.



The variable vapor space in a Vapor-Lift tank is positively sealed so that vapors will not escape, breathing losses will be eliminated, filling losses reduced and the quality of the stored product maintained.

A single Vapor-Lift Roof Tank (available in sizes up to 100,000 bbl.) provides excess vapor capacity to accommodate the breathing of additional cone roof tanks.

Bulletin VLR-1 containing complete details will be sent upon request.

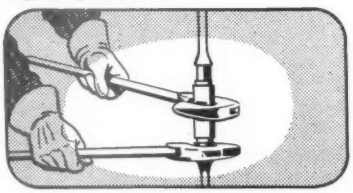
HAMMOND IRON WORKS

New York Warren, Pa. **Cleveland**

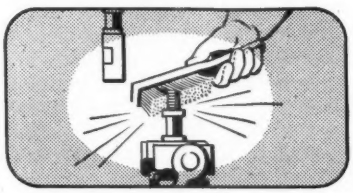
SIMPLE RULES TO *Save* SUCKER RODS

Based on Jones engineering tests and laboratory experiments and the practical field experience of independent operators and producing companies over a long period of time and under operating conditions in many oil fields, the Jones company offers the following set of simple rules which will reduce pumping problems, shutdown and repair jobs:

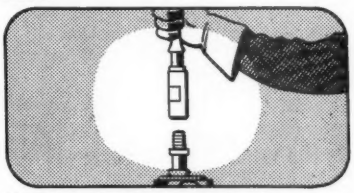
1 Loose joints cause pin failures. When running in, make up with ordinary wrenches, then snap with large snap wrenches.



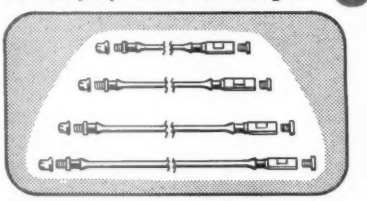
2 Use cleaning fluid freely with wire brush on pin end Threads—use a box washer on box ends.



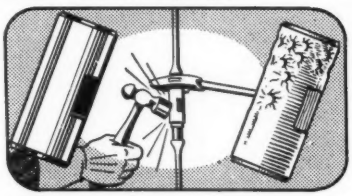
3 Before stabbing, be sure rod is hanging straight in derrick and the threads are properly lubricated.



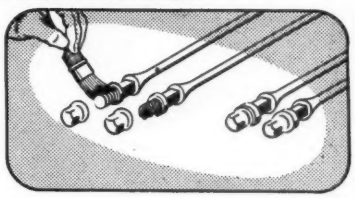
4 Use new pony rods on new strings.



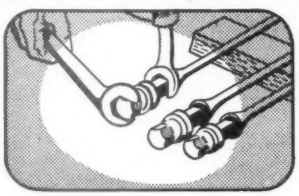
5 Do not hammer couplings.



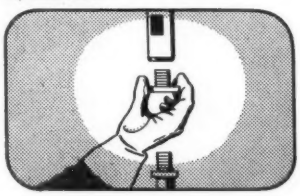
6 Use thread protectors, after cleaning and doping threads of all storage racked strings.



7 Do not loosen protectors by pounding. Loosen with wrench — unscrew by hand.

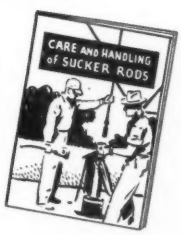


8 Do not remove protectors until rods are hanging in the derrick.



On tough wells, under unfavorable field and operating conditions, JoneSuckeRods have produced literally millions of barrels of oil without a failure.

Write for your copy of "Care and Handling of Sucker Rods." Available in either English or Spanish; specify which.



The S.M. Jones Co.

JoneSuckeRods

General Office and Factory: Toledo, Ohio Sales Office: McBirney Bldg., Tulsa, Okla.
Export Office: 122 East 42nd St., New York 17, N. Y.

A "STRING" of Jones Sucker Rod "FIRSTS"

First to make an all-metal and double pin box sucker rod.

First to end normalize and to fully normalize a sucker rod.

First to use carbon manganese steel for sucker rods.

First to use metal pin and box thread protectors and automatic machines for threading sucker rods.

First to introduce a low metalloid rod to relieve corrosion and load problems.

First to establish a Field Engineering Department.

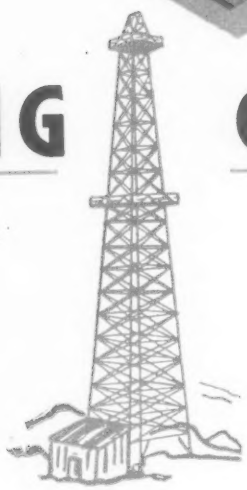
First to remove mill and forging scale by shot blasting.

First to nickel plate sucker rods.

"SLOW METER?"

DRILEXCO

DRILLING CONTRACTORS



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CONTINENTAL BLDG.
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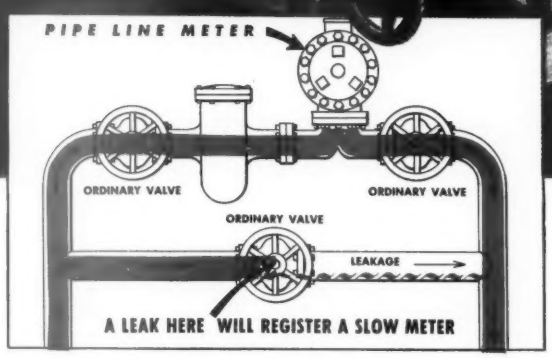
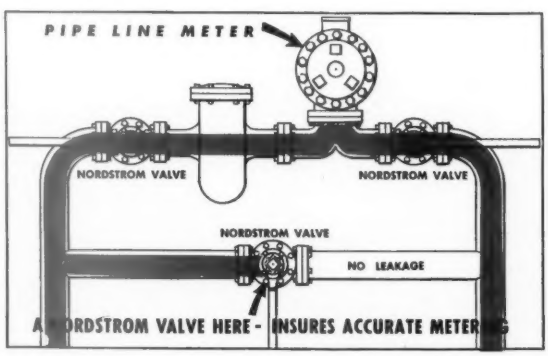
ARE THERE GREMLINS IN YOUR BY-PASS?





LEAKY VALVES ON BY-PASSES CAUSE INACCURATE METERING

LEAKING gate valves on by-passes cause under-registration of the meter. This is especially true on pipe lines and at pipe line terminals using large oil meters. Losses can run as high as 5% to 10%. Unless the operator is aware of this leakage, the meter is usually blamed for inaccuracy. It isn't the meter's fault. A tight, leak-proof valve on the by-pass is absolutely necessary.

To assure complete satisfaction from any meter setting, use Nordstrom Valves on the by-pass. Not a drop of the line fluid (or gas) can pass a closed Nordstrom. If your meters are running slow, check your by-pass. *Change to Nordstroms.* Gas companies have learned by experience that Nordstrom Valves are essential on the by-pass. Many gas operators have made Nordstroms standard equipment for all meter settings.

NORDSTROM *Lubricated* **VALVES**

A valve principle, centuries-old, becomes indispensable in many plants

OLDEST of devices used by man for the control of fluids in closed conduits is the tapered plug valve. In the form of the common "stop-cock" it has been in general use since very early times, but only in the smaller sizes and for moderate services.

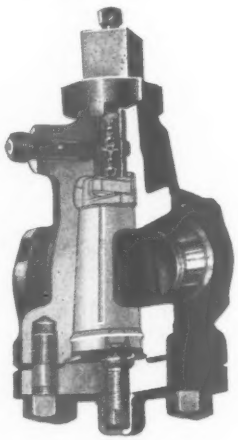
It was not until the advent of the Nordstrom pressure-lubrication principle (1916) that the plug valve became available for the full range of heavy-duty process and industrial uses. Since that time, this principle has been built into Nordstrom Valves of many sizes, styles and materials to meet the demands of practically every branch of the piping industry.

FUNCTIONS OF VALVE LUBRICATION

The functions of pressure lubrication in Nordstrom Valves are: (1) *Hydraulic action,* keeping the plug in free working condition; (2) *Maintenance of positive seal* against internal and external leakage; (3) *Free turning,* even of the largest sizes and against heavy differential pressure; (4) *Protection of working surfaces* from wear and corrosion. Thus, the Nordstrom principle of lubrication has made it possible to take full advantage of the inherent simplicity, compactness and positive rotary action of the tapered plug valves.

LUBRICATION IS VITAL

Lubrication of a tapered axle skein is necessary for easy rotation and long life of the metal contacting surfaces. Lubrication is even more important in a valve. For extra long life lubrication must be used.



Hypreseal Type

TAPERED PLUG

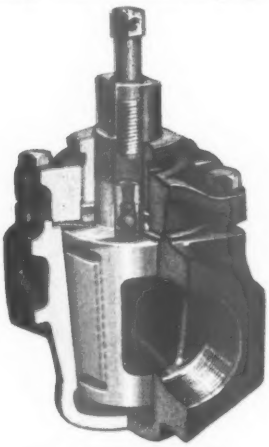
The tapered form of plug and seat provides an intimate fit, regardless of the thickness of lubricant film. Even with a complete absence of lubricant, the plug and body have a ground-joint, metal-to-metal contact. The positive rotary action of the tapered plug valve provides inherent protection of the seating surfaces against corrosion, erosion or accumulation of solids.

LUBRICANT "JACKING"

In all Nordstrom Valves, lubricant forced in under pressure produces a momentary lifting movement of the plug, which overcomes any adhesion and, because of the taper, creates a small space for a lubricant film between the plug and body.

RESILIENT SEATING

In every type of Nordstrom Valve, the arrangement which holds the plug in place has a small, but highly important, degree of resiliency. This prevents binding and allows the lubricant "jacking" action to function properly.



Regular Screwed Gland Type

"SEALDPORT"

In the Nordstrom patented *"Sealdport"* system, the grooves are divided between the body and plug in such manner that the exposed groove sections are disconnected from the lubricant supply before they are brought in contact with the line-fluid space. These grooves are automatically reconnected when the plug is brought to the fully open or closed position. Ports are completely surrounded by a lubricant film, preventing leakage past any part of the port boundary.

Nordstrom LUBRICATED VALVES

Sealdport Lubrication

MERCO NORDSTROM VALVE COMPANY — *A Subsidiary of Pittsburgh Equitable Meter Company*

Main Offices: 400 Lexington Avenue, Pittsburgh 8, Penna. • *Branches:* Atlanta, Boston, Brooklyn, Buffalo, Chicago, Columbia, Houston, Kansas City, Los Angeles, New York City, Oakland, San Francisco, Seattle, Tulsa • *Canadian Licensees:* Peacock Bros., Ltd., Montreal
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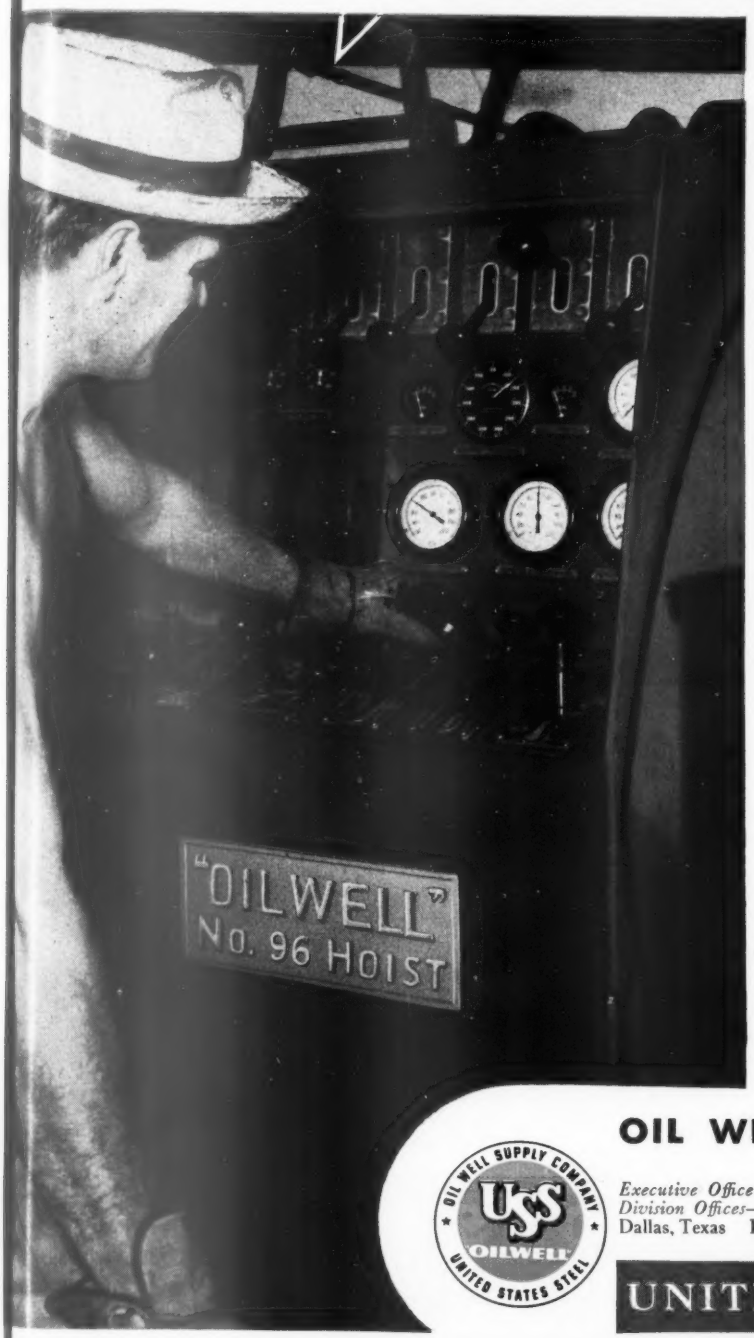
PRODUCTS: Nordstrom Lubricated Valves; Air, Curb and Meter Cocks • Nordco Valve Lubricants • EMCO Gas Meters • EMCO-McGaughy Integrators
EMCO Regulators • • Pittsburgh-National Meters for Gasoline, Grease, Oil, Water and other Liquids • Stupakoff Bottom Hole Gauges

"THIS IS THE RIG THAT'S *Worth Waiting For!*"



—that's what DRILLERS are saying about "Oilwell's" NEW POWER RIG for deep drilling

THIS IS THE RIG we've tried to keep "under wraps" until we were in position to make immediate deliveries.

But we just couldn't do it!

Since the very first unit was placed in field service, oil operators have flocked to see it—and almost every one who watched it perform . . . handled its controls . . . felt its immediate response . . . noted its compact design . . . has asked but one question, "How soon can I get delivery?"

Now that the news is out we invite your inquiries and inspection at the earliest opportunity.

OIL WELL SUPPLY COMPANY

Branches Serving All Oil Fields

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UNITED STATES STEEL

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. . . it contains the answers

The Oil and Gas Industry calls for especially designed and manufactured wire rope, if dependable results are to be obtained. That's why we want you to have a copy of our latest catalog devoted exclusively to wire rope and wire rope fittings for the Oil and Gas Fields.

It answers in text and illustrations every questions pertainent to your particular requirements, and you will find it a reliable, as well as a handy reference work. Tell us where to send YOUR copy . . . we'll do it gladly—promptly.

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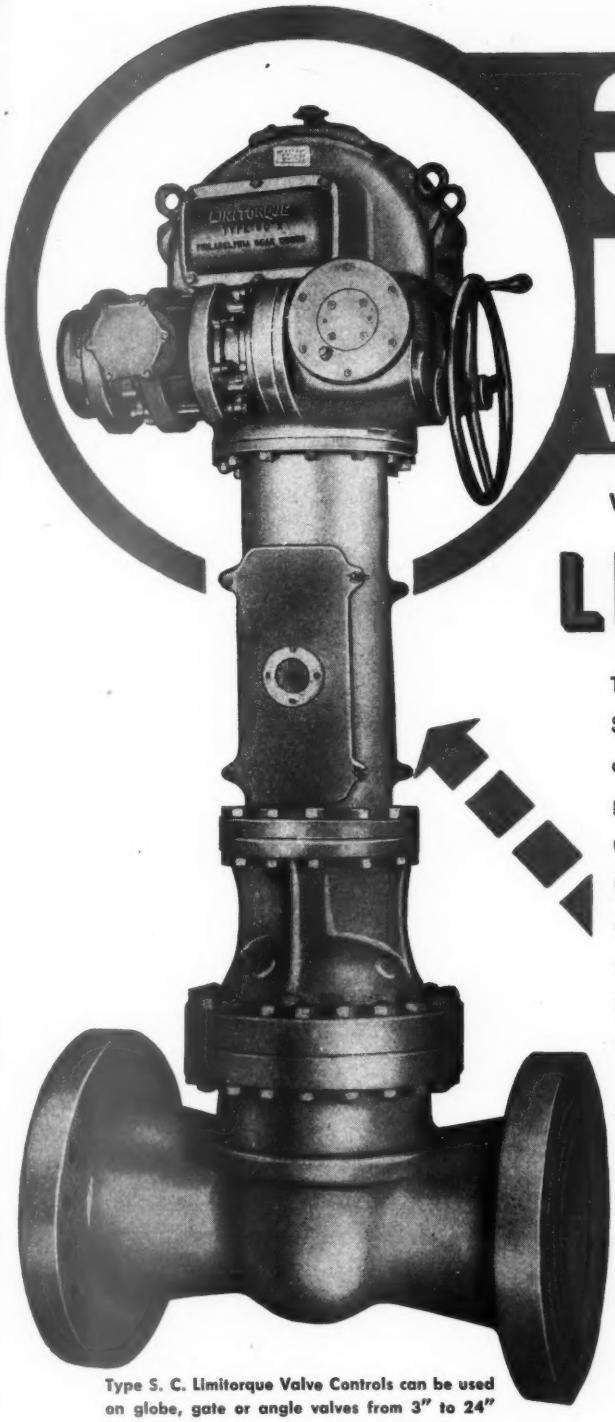


3 TIMES FASTER VALVE OPERATION

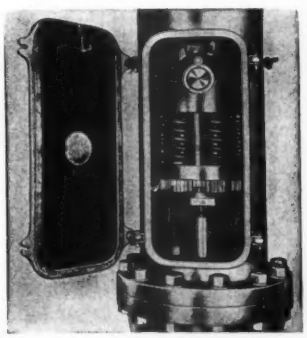
with the automatic, trouble-free

LIMITORQUE

The radically different principle of actuation in the Type S. C. Limitorque Valve Operator makes it ideal for use on catalytic cracking, hydroformer and similar cycling plant valves in refineries producing Petro-chemical products, gasoline, etc. A crank type mechanism in the control opens or closes a valve up to 3 *times faster* than the conventional type operator . . . a 24" gate valve, for example, can be opened under full unbalanced conditions in 3 seconds. Consider the added production this will permit.

Type S. C. Limitorque Valve Controls can be used on globe, gate or angle valves from 3" to 24" diameter.

Hundreds of these controls installed or specified by leading companies attest their value. For more complete mechanical details, write us.



View showing spring compensated cross head guiding valve stem and connection with valve stem. Thrust adjustment mechanism and thrust indicator.

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BARREL Uniformly hardened (Rockwell 64 to 70c) and accurately honed (every barrel held to a tolerance plus or minus .0005).

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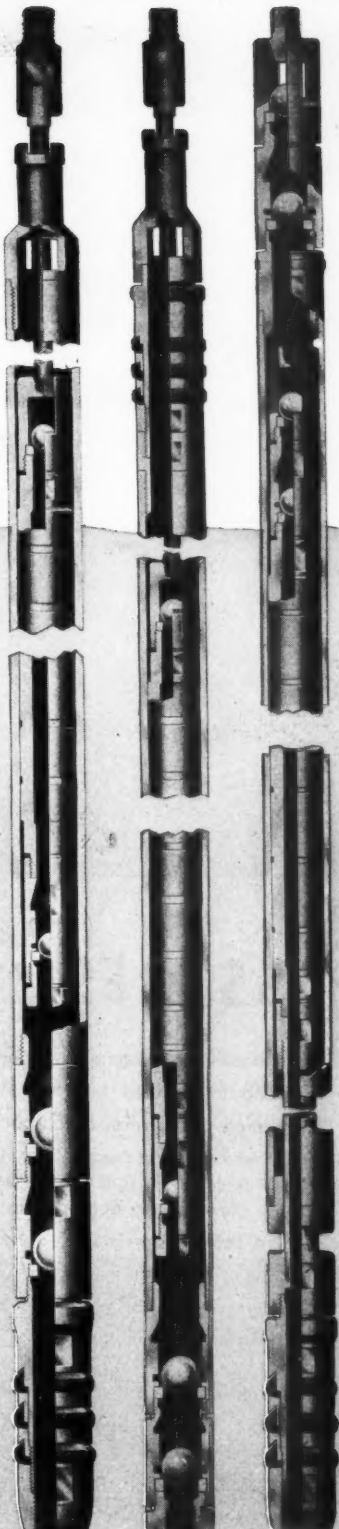
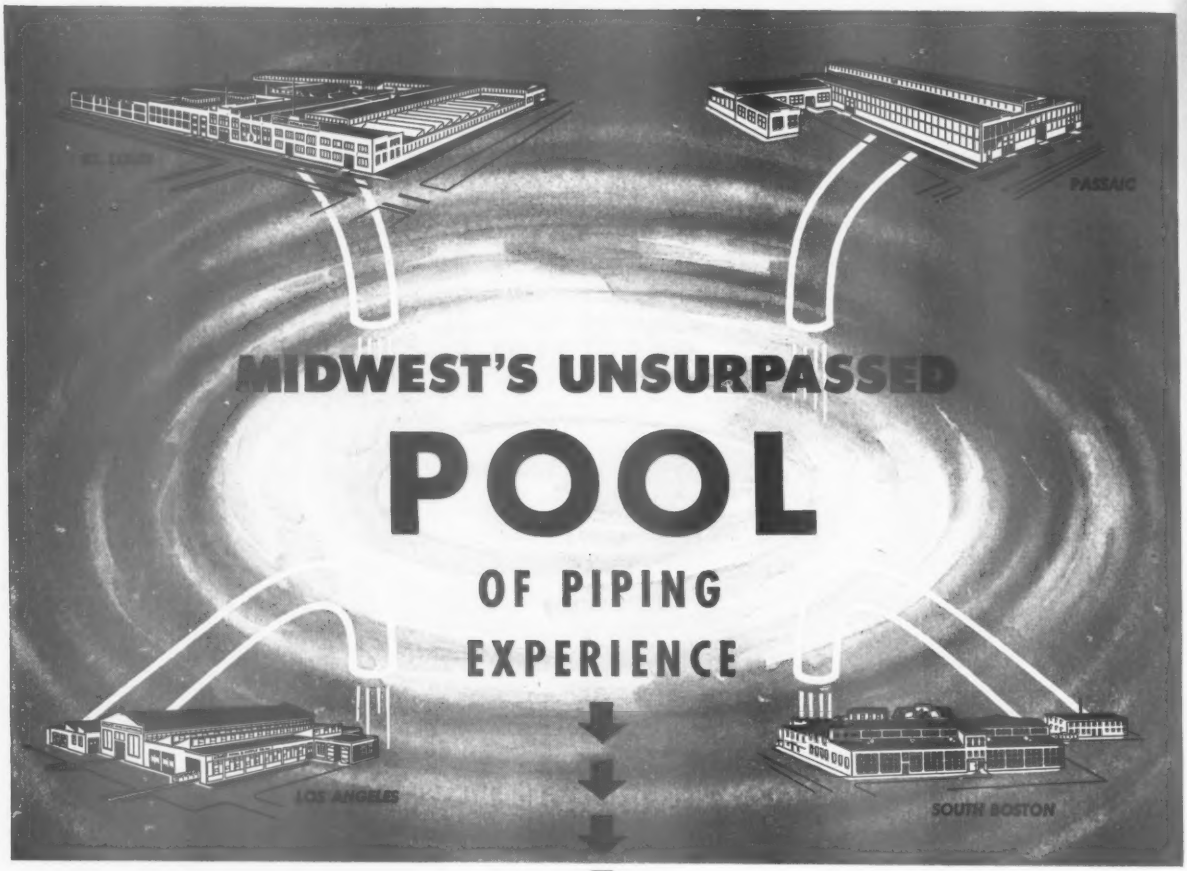


Stationary Barrel Bottom Anchor | Stationary Barrel Top Anchor | Travelling Barrel Bottom Anchor



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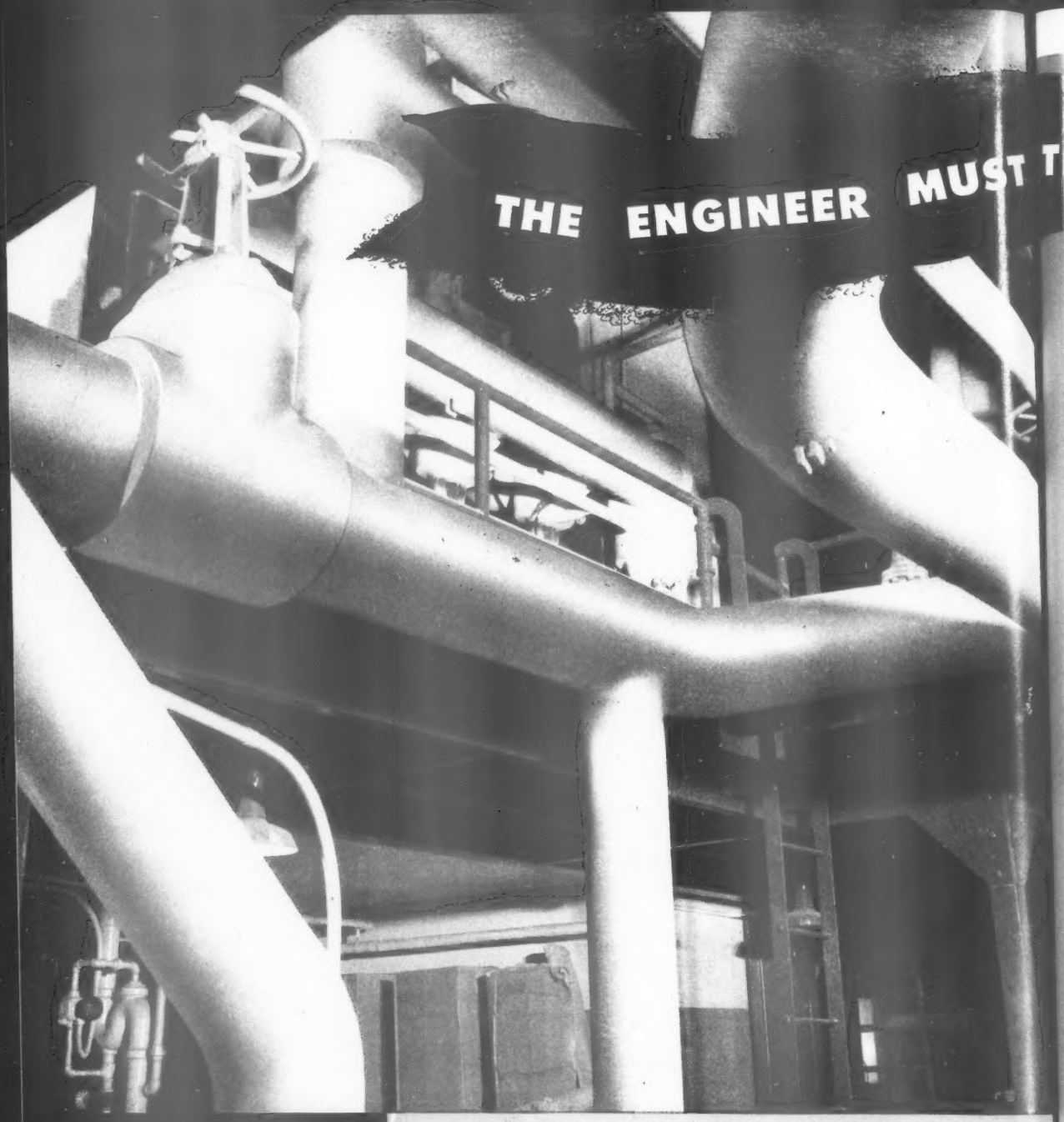

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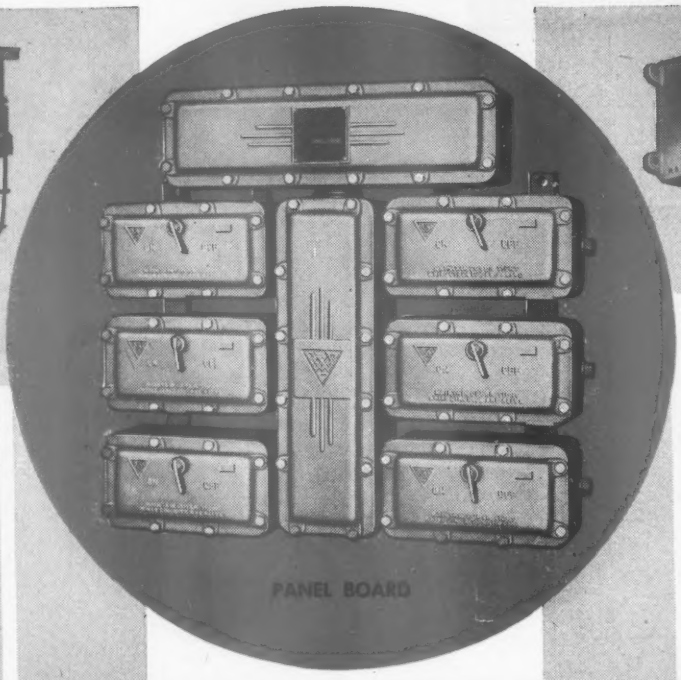
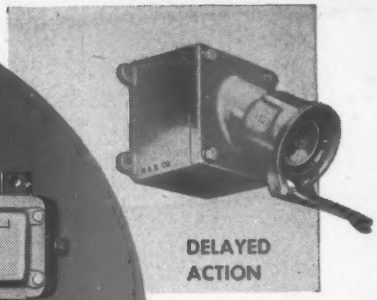
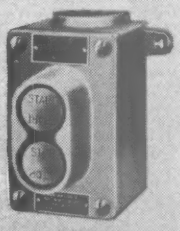


PANEL BOARD

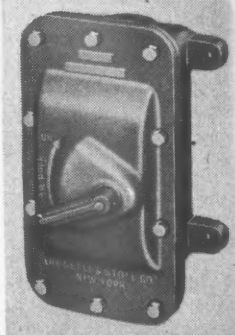


DELAYED ACTION

PUSH BUTTON



STATION



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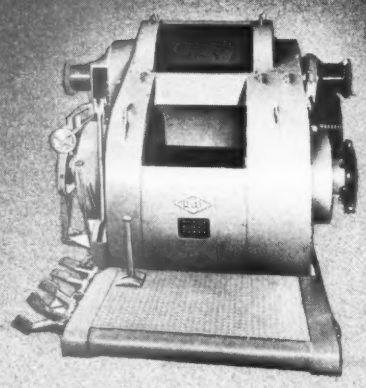

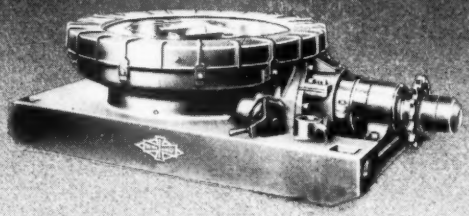

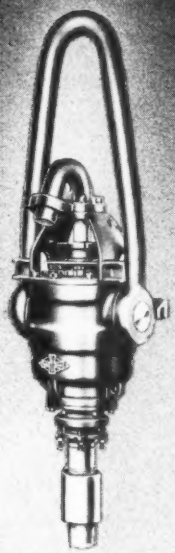

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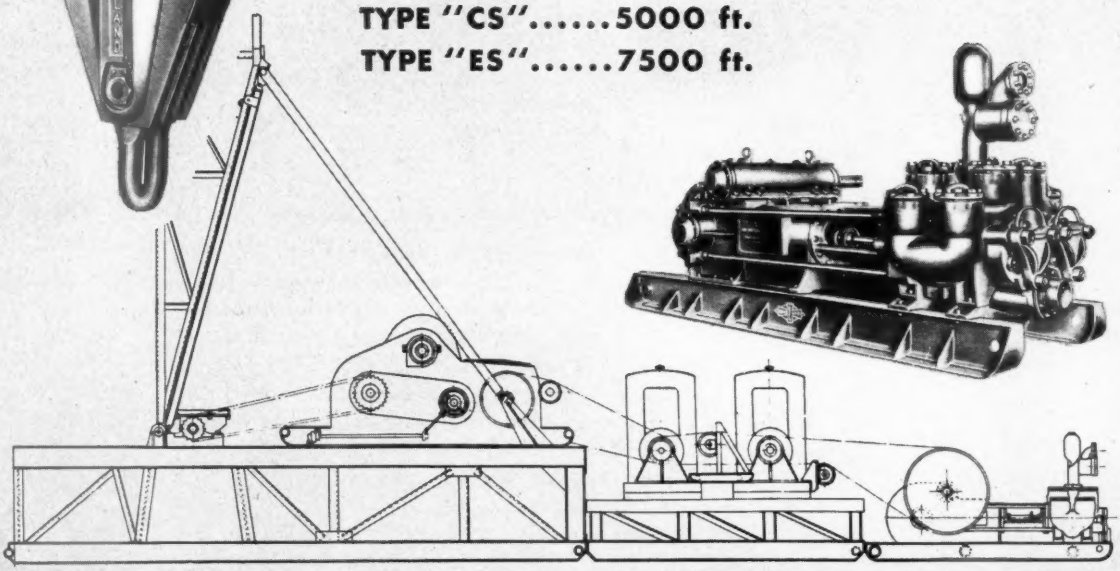

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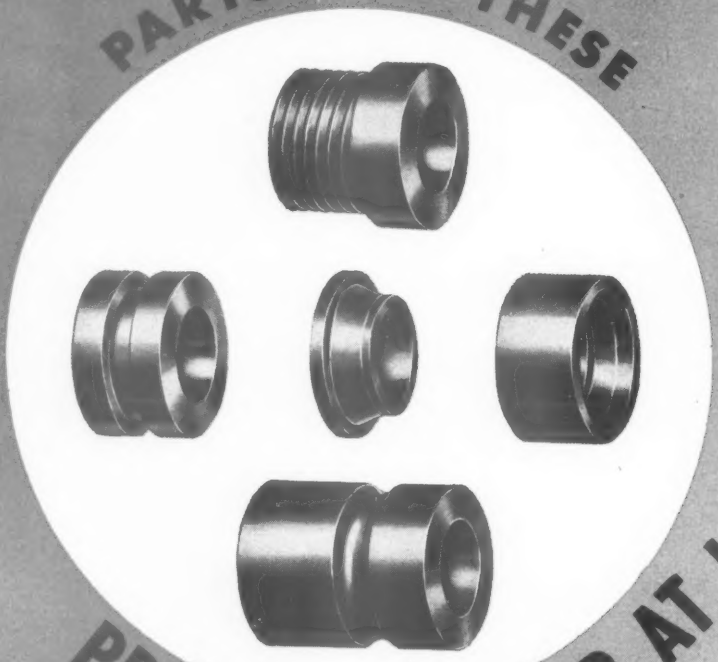

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from Rockrite tubing

**The demand for the
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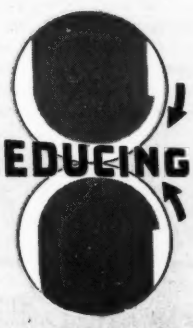

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LINE PIPE
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In oil-land's mud and gumbo, on the toughest "off-the-road" terrain — FWD's constantly prove their worth. The stamina, power, and rugged dependability of all-wheel-drive FWD's have been demonstrated in the oil-fields of the world.

Specialized truck engineering based on close contact with oil-field truck needs have made FWD's standard equipment for oil-field operations.

FWD builds four-wheel and six-wheel drive trucks in sizes ranging from 2 to 25 tons capacity. Look into all the specialized features that qualify FWD's for profitable performance in your operations.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
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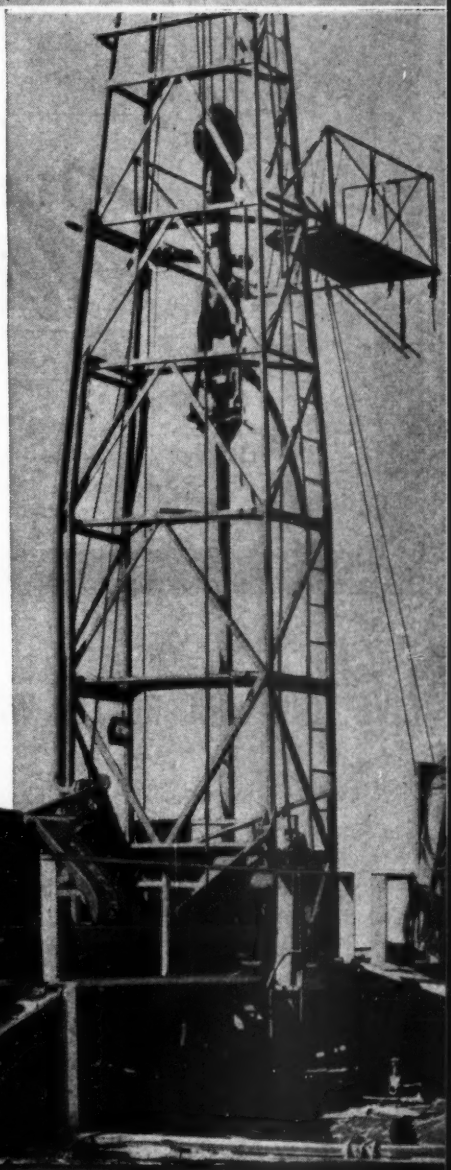
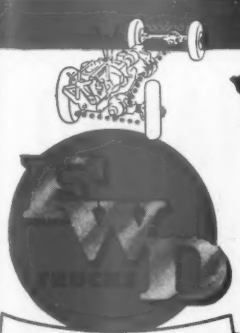
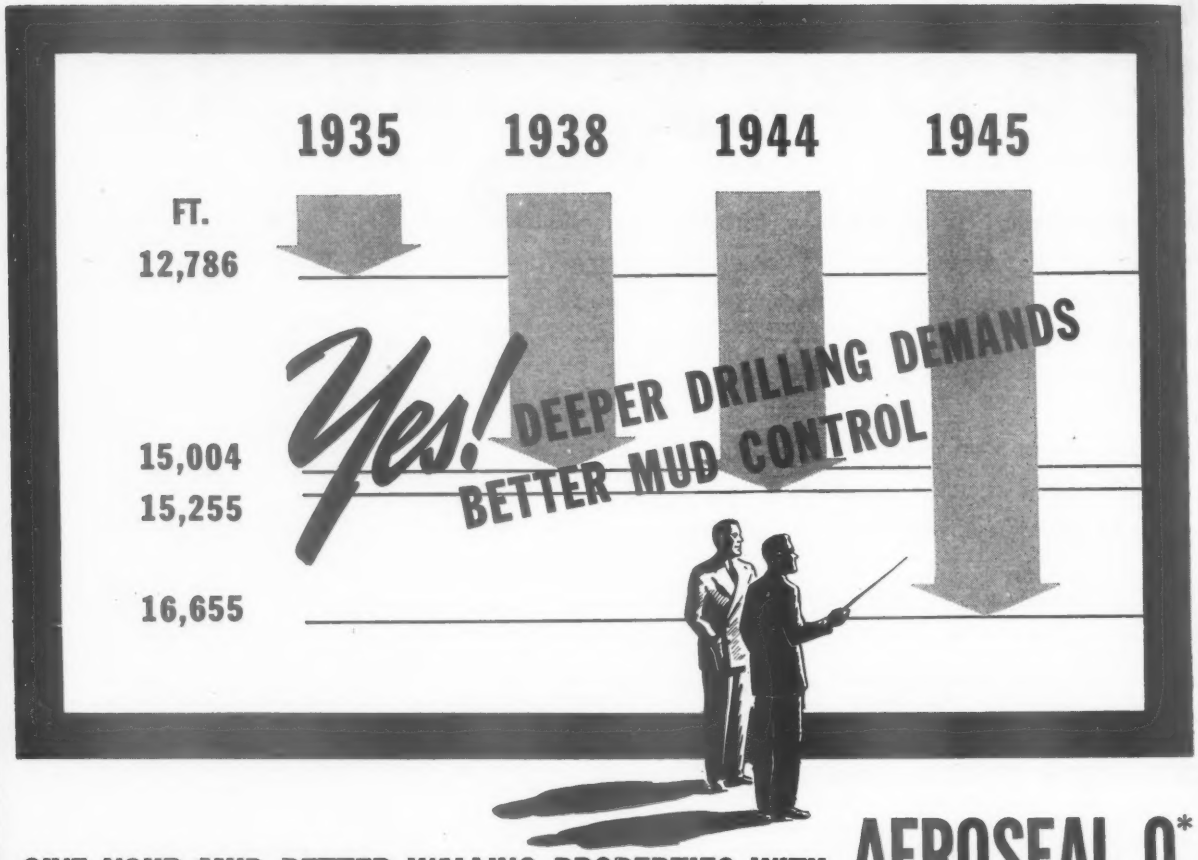




FWD Model HA equipped with platform type body, winch and derrick for oil field service.

One of a fleet of more than 400 FWD's serving Halliburton Oil Well Cementing Company.



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Deeper drilling plans call for *faster* and *more efficient* drilling—and, better mud control. Among the various mud conditioning chemicals offered by Cyanamid is AEROSEAL Q Drilling Mud Conditioning Compound, a new and remarkably effective compound for assuring low water loss and a thin, tight mud cake at all times and under virtually all conditions. It gives maximum protection for walls and helps to assure continuous, uninterrupted production by greatly reducing the danger of tight hole and stuck pipe.

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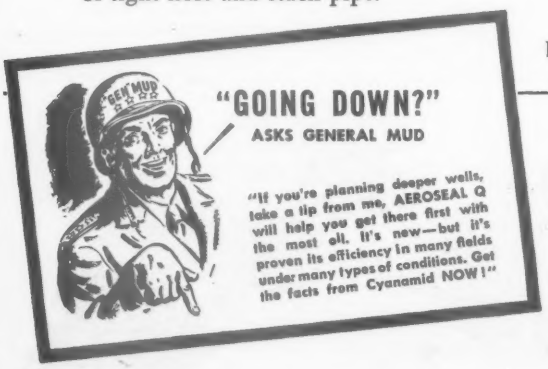
*Trade-Mark


SEE MUD
"GOING DOWN?"
ASKS GENERAL MUD
"If you're planning deeper wells, take a tip from me, AEROSEAL Q will help you get there first with the most oil. It's new—but it's proven its efficiency in many fields under many types of conditions. Get the facts from Cyanamid NOW!"

When Performance Counts—Call on Cyanamid

American CYANAMID & Chemical Corporation

(A UNIT OF AMERICAN CYANAMID COMPANY)

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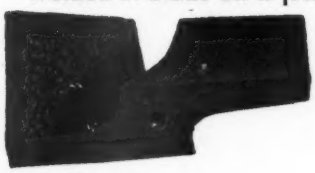
HUNT *Export Model* WELDED-IN BLADE BIT

Already Accepted by the Export Trade as a New Standard for the Industry!

In less than a year, Hunt's new Welded-in Blade Bit has been enthusiastically accepted throughout the export field as a new standard for economical, efficient drag bit drilling.

And behind the volume of repeat orders is an idea revolutionary in drag bit improvement. Especially adapted for the export trade, the new Hunt Welded-in Blade Bit is just as practical and serviceable in domestic fields.

The new Hunt Welded-in Blade Bit does away with the use of a lot of costly equipment. It saves valuable time . . . and costly trouble. Forged alloy steel blades come to you, ground sharp and to gauge.



2-way Blade. Note locating hole.

2-way Head. Note Locating Pin.

2-way head and blade assembled, set in position to weld, and finished bit. Since 2-way blade cannot be moved laterally, the locating pin and hole are not necessary.

- No Jigs—No Gauges—No Fixtures . . . just seat the blades and weld.
- Eliminates error in blade replacement.
- Insures sharp, full gauge blades.
- Saves costly time . . . expensive trouble.

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EXPORT SALES: Hunt Export Company, 19 Rector St., New York
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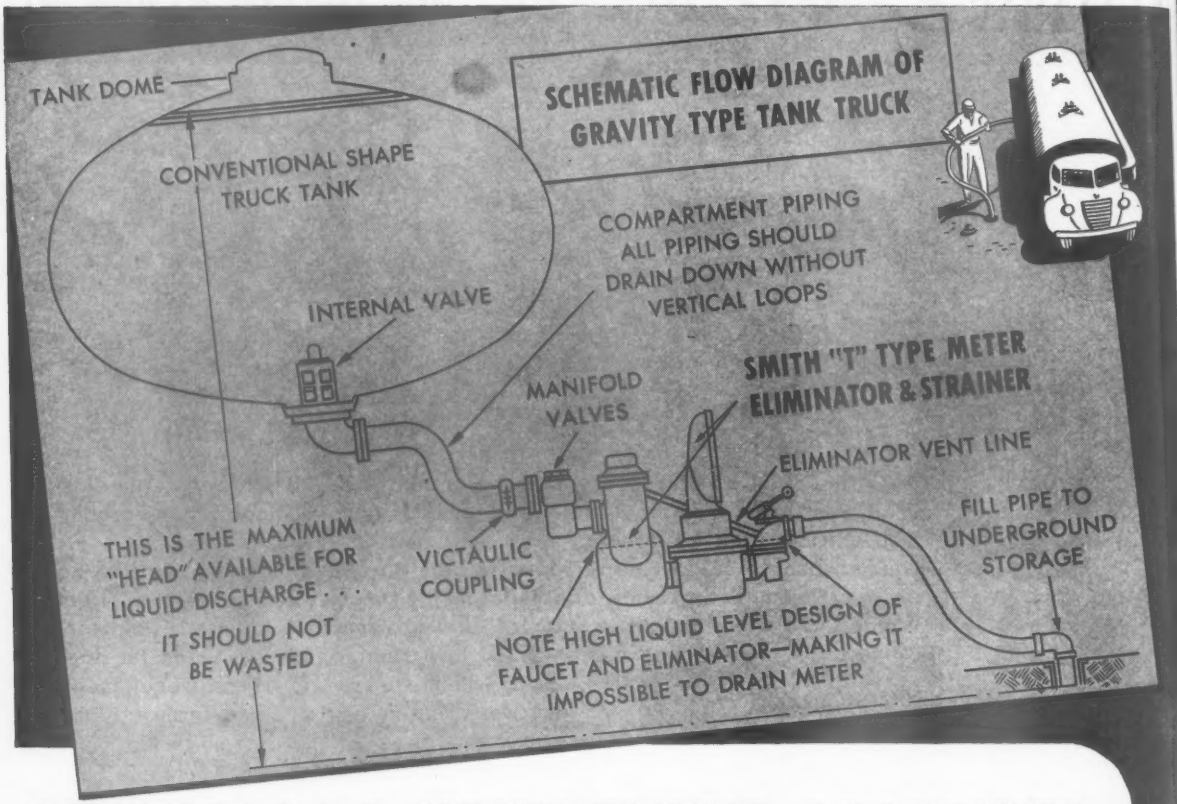
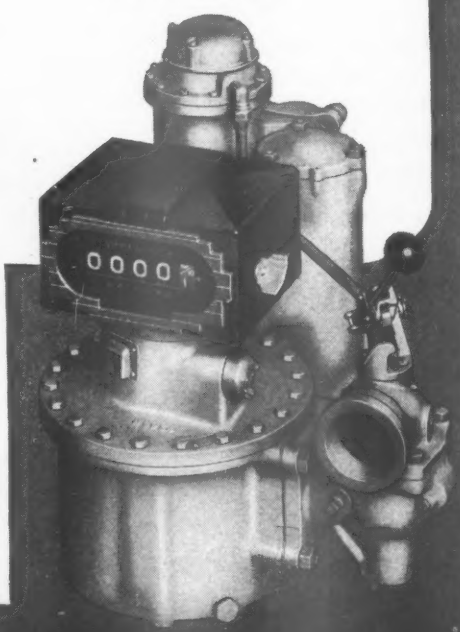
A BUSINESS BUILT ON SERVICE


SCHEMATIC FLOW DIAGRAM OF GRAVITY TYPE TANK TRUCK
TANK DOME
CONVENTIONAL SHAPE TRUCK TANK
INTERNAL VALVE
COMPARTMENT PIPING ALL PIPING SHOULD DRAIN DOWN WITHOUT VERTICAL LOOPS
MANIFOLD VALVES
SMITH "T" TYPE METER ELIMINATOR & STRAINER
ELIMINATOR VENT LINE
FILL PIPE TO UNDERGROUND STORAGE
THIS IS THE MAXIMUM "HEAD" AVAILABLE FOR LIQUID DISCHARGE . . . IT SHOULD NOT BE WASTED
VICTAULIC COUPLING
NOTE HIGH LIQUID LEVEL DESIGN OF FAUCET AND ELIMINATOR—MAKING IT IMPOSSIBLE TO DRAIN METER

HOW FAST DO YOU DELIVER GASOLINE?

An Important Question!

FAST DELIVERY is essential on any gravity gasoline delivery truck . . . it is the sure way to reduce man hours and truck operation costs. Loss of Flow must be avoided and every ounce of "head" used to speed discharge. Smith Rotary Meters . . . the design with the minimum obstruction to flow . . . properly installed, will give you high speed delivery. Examine your present delivery rates and you'll see why more and more fleet owners are specifying Smith Meters. THE OWNER OF A SLOW SPEED METER CONTINUES TO PAY FOR THAT METER IN LOST TIME EVERY DAY IT OPERATES. Call the nearest Smith Representative and start reducing costs *now*.



Illustrated, Model T-15. Other sizes available with accessories to suit varying delivery conditions. All are built on the simple SMITH ROTARY PRINCIPLE, dependable, accurate and fast.

The design that revolutionized the meter industry.

SMITH METER COMPANY

SUBSIDIARY OF A. O. SMITH CORPORATION

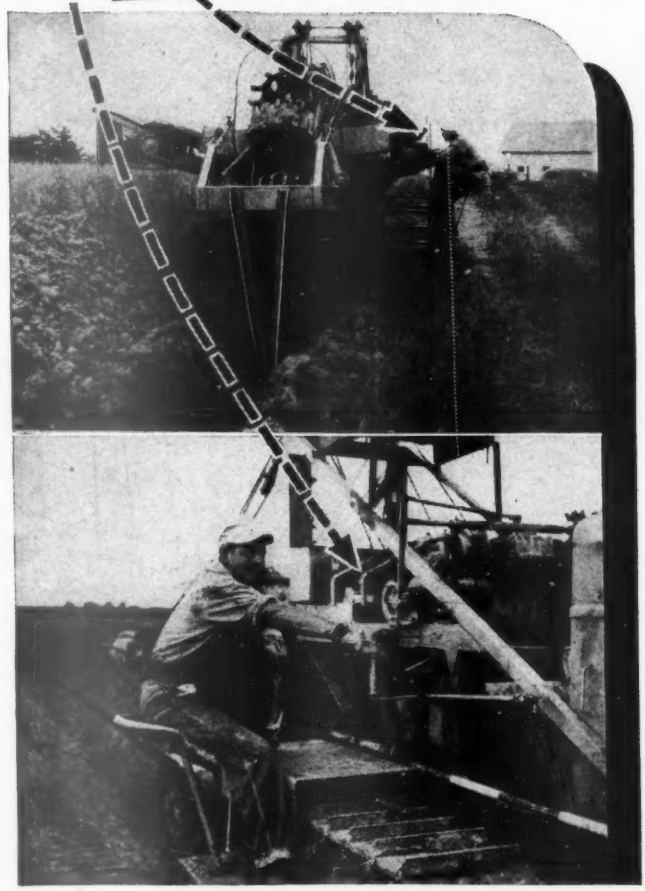
Factory—5743 Smithway, Los Angeles 22, Calif.

SALES OFFICES: NEW YORK, CHICAGO, HOUSTON, LOS ANGELES
LOCAL STOCKS AT CONVENIENT POINTS • LOCAL AGENTS IN ALL PRINCIPAL CITIES

simplicity

OF CONTROL —

Yet Maximum Range of Speeds and Feeds!



Buckeye Trenchers are noted for their ability to dig through anything short of solid rock. In hardpan, clay, gumbo, shale or other tough soil conditions, they trench faster and at lower cost per cubic yard, lineal foot or any way you choose to figure it. In freer soils, these same machines will dig trench at speeds up to 35 feet per minute.

On the Model 12, pictured, there are in all 25 different digging feeds, and a wide range of travel speeds! Yet look at the simple controls! Old timers or inexperienced operators can quickly and easily adjust the feed and crowd to suit the digging needs of varying soil conditions. This means time saved —more trench per shift—more profit per contract.

Get the facts on Buckeye Pipeline Trenchers today. Send for bulletins.

THERE'S A FAST-DIGGING, COST-CUTTING BUCKEYE TRENCHER FOR EVERY PIPELINE REQUIREMENT!

ARMY NAVY

Built by **Buckeye**

Buckeye Traction Ditcher Co., Findlay, Ohio

Convertible Shovels

Trenchers

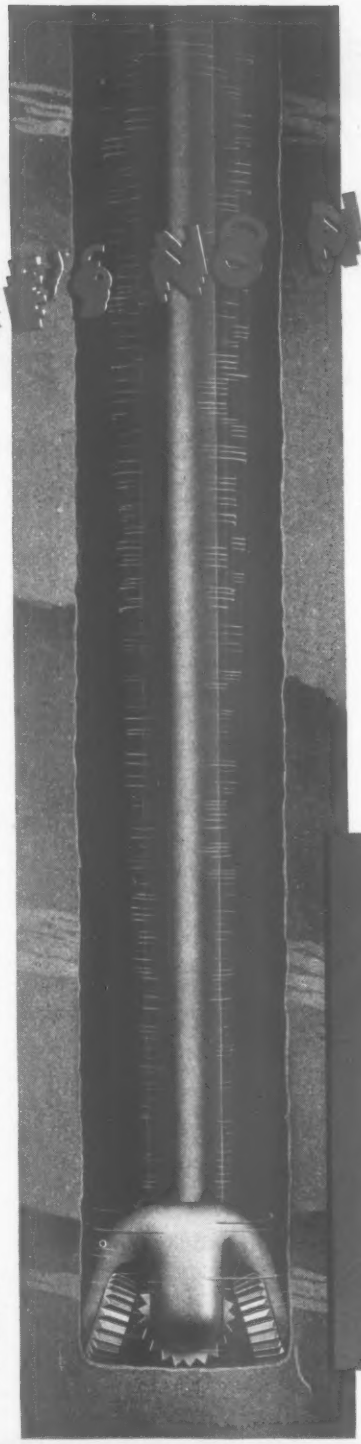
Tractor Equipment

Road Wideners

R-B Finegraders

Spreaders

THERE'S NO NEED FOR THIS"



ELIMINATE VIBRATION WITH A SIEVERS REAMER!

***Vibration is the enemy of your drill string*—Constant flexing weakens pipe and connections... shortens equipment life... and leads to twist-offs and expensive fishing jobs. *What's more, vibration cuts drilling efficiency*—for a dancing bit can't drill as straight, or *as fast*, as a bit centered firmly in the hole.**

SIEVERS PERFORMANCE FEATURES GIVE YOU:

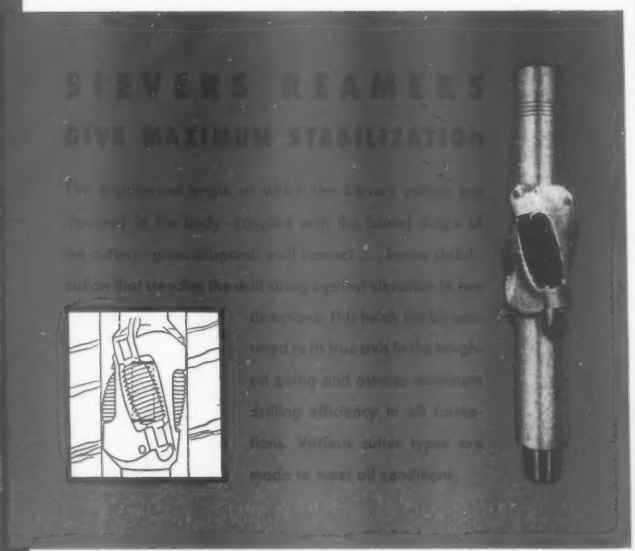
SMOOTHER, FASTER DRILLING—The exclusive Sievers Slicing Action aids—instead of hinders—the digging speed of the bit.

R-O-U-N-D FULL GAUGED HOLE—Because of the diagonal wall contact, the reamer will not push through tight spots without first reaming them out to full gauge.

BETTER DIRECTIONAL DRILLING—The diagonal wall contact gives better bearing area for holding the bit to a pre-determined course.

HIGHER CORING EFFICIENCY—A Sievers Reamer above the core barrel holds the barrel centralized on its true axis. Result—higher recovery, less core breakage.

WHETHER IT'S REAMING OR STABILIZING—OR BOTH—YOU'LL DO IT BETTER WITH A SIEVERS!



A full description of the Sievers Reamer is in your Composite Catalog.

SECURITY ENGINEERING CO., INC.

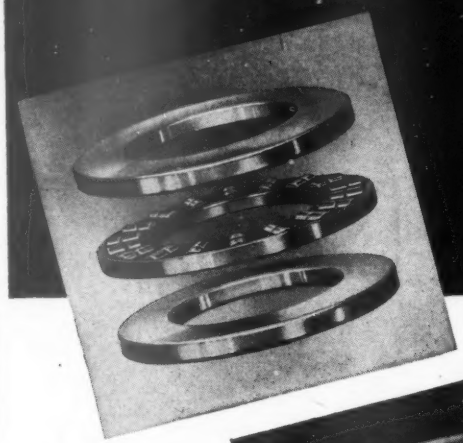
Main Office and Plants: Whittier, California

EXPORT OFFICE: SUITE 800 CHANIN BUILDING, 122 EAST 42nd STREET, NEW YORK 17, NEW YORK

Branches in All Principal Oil Fields

RIGHT ANGLE LOADING

Plus staggered rollers that will not "TRACK"...



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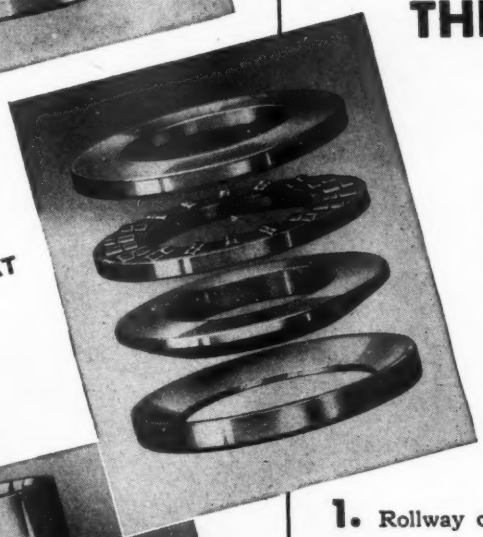

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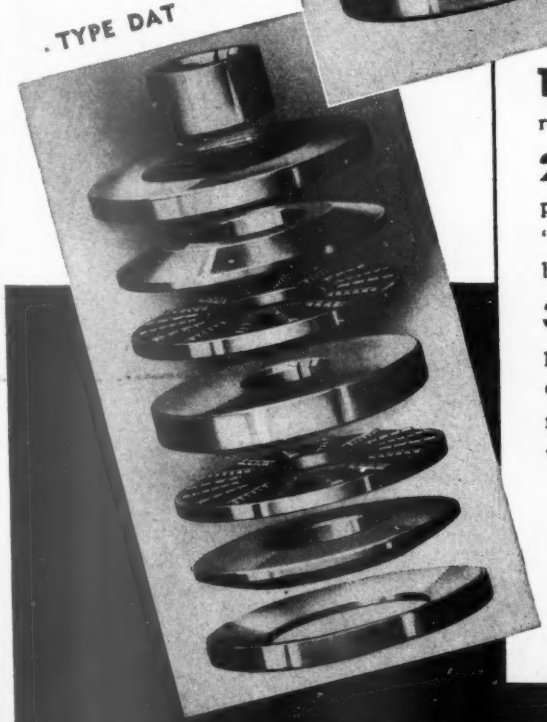


ROLLWAY

Solid-cylindrical-roller THRUST BEARINGS

When thrust loads are heavy . . . when maximum bearing capacity in minimum space is required . . . when the aim is to design "preventive maintenance" into the mechanism itself . . . Rollway solid cylindrical roller Thrust Bearings offer sound solutions to the basic problems. Here are the reasons why:

1. Rollway carries all loads at right angles to the roller axes.

2. Rollway solid-cylindrical rollers—staggered in position and varied in length, so as to cancel out "tracking"—are accurately spaced in machined-bronze retainers.

3. Thrust plates, held to extremely close limits of parallelism, afford a linear contact with the straight cylindrical rollers, doing away with Brinell effect and roller "pinch outs" with its consequent roller-end wear and rubbing friction.

Six basic types in many sizes to choose from. Send a print or detailed description for free bearing recommendation.

ROLLWAY BEARING CO., INC.
SYRACUSE 4, N. Y.

SALES OFFICES: Philadelphia · Boston · Pittsburgh · Youngstown · Cleveland · Detroit · Chicago · St. Paul · Houston · Tulsa · Los Angeles

Preformed wire rope

MULTIPLIES MANPOWER 3 WAYS

Men who actually work with wire rope prefer preformed. They give many different reasons for this choice, but the net result is more work per line before replacement.

The men say preformed wire rope handles easier. It saves installing time; it's limber—not cranky.

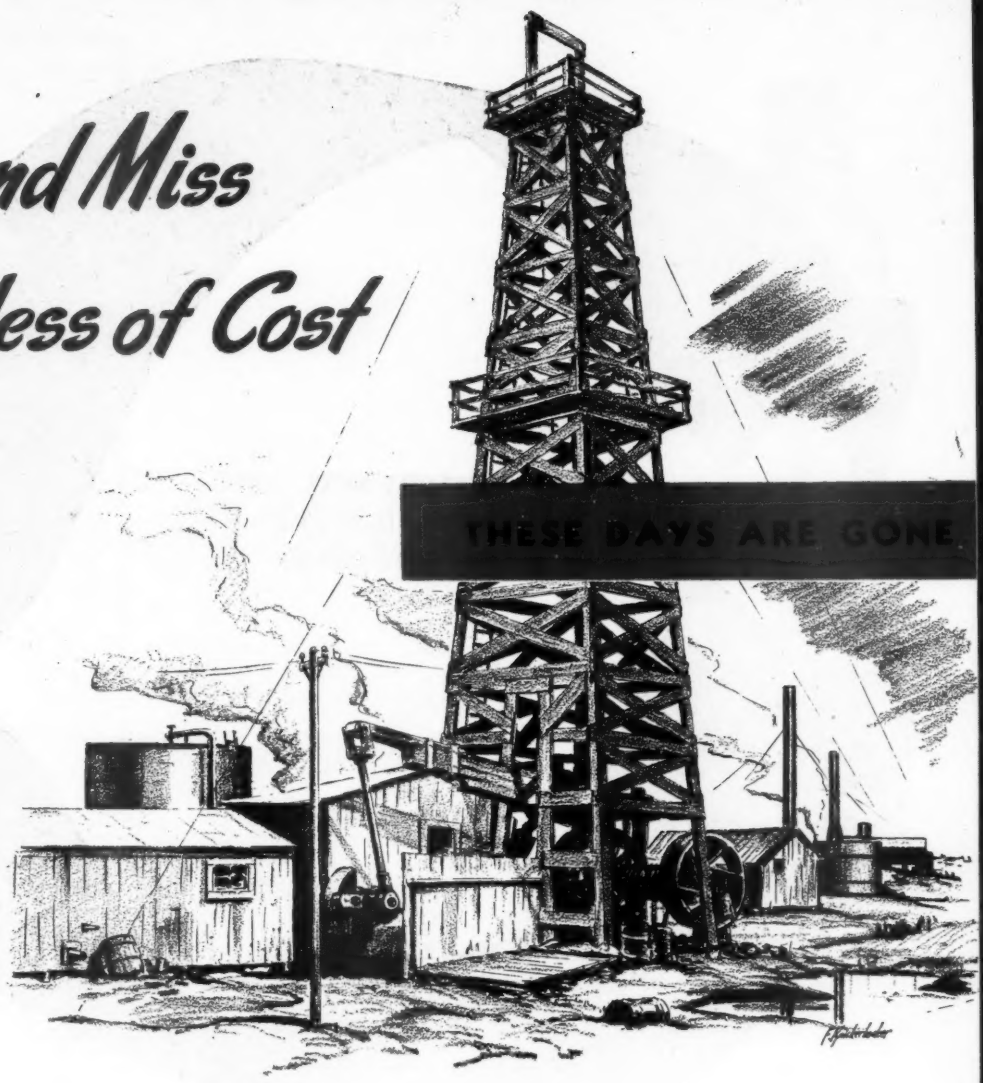
They say it whips less and spools better on drums.

It lasts longer and this means fewer interruptions to production.

Preformed wire rope costs a little more at first but much less in the long run.

ASK YOUR OWN WIRE ROPE MANUFACTURER OR DISTRIBUTOR

Hit and Miss Regardless of Cost



Precision engineering as practiced by OTIS is helping to fulfill the industry's growing demand for higher efficiency and greater economy. Closer tolerances and standard specifications, plus extensive research in the use of alloy steels, have replaced the "hit and miss, regardless of cost" production methods.

Behind these achievements and the OTIS engineering organization, there is a thoroughly modern, war-experienced precision production plant . . . facilities that assure increasingly higher quality and interchangeability of OTIS Sub-Surface tools and their component parts.

These contributions to the oil industry plus a consistent record of reliable field service and counsel have given OTIS full recognition as the foremost leader in the design and manufacture of sub-surface pressure controls.

OTIS PRESSURE CONTROL EQUIPMENT

OTIS PRESSURE CONTROL, INC.

SALES AND SERVICE • • • DALLAS 9, TEXAS

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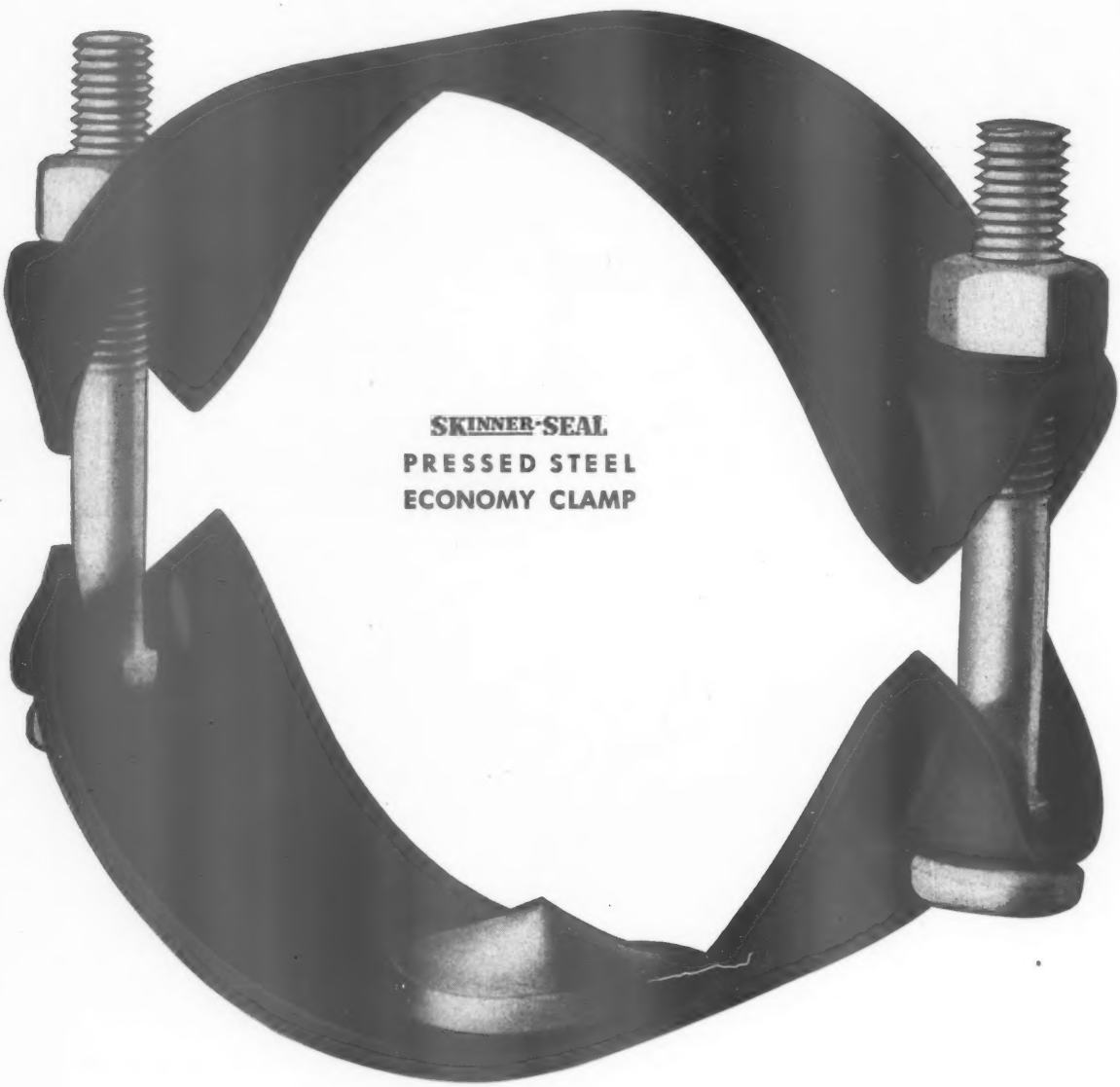
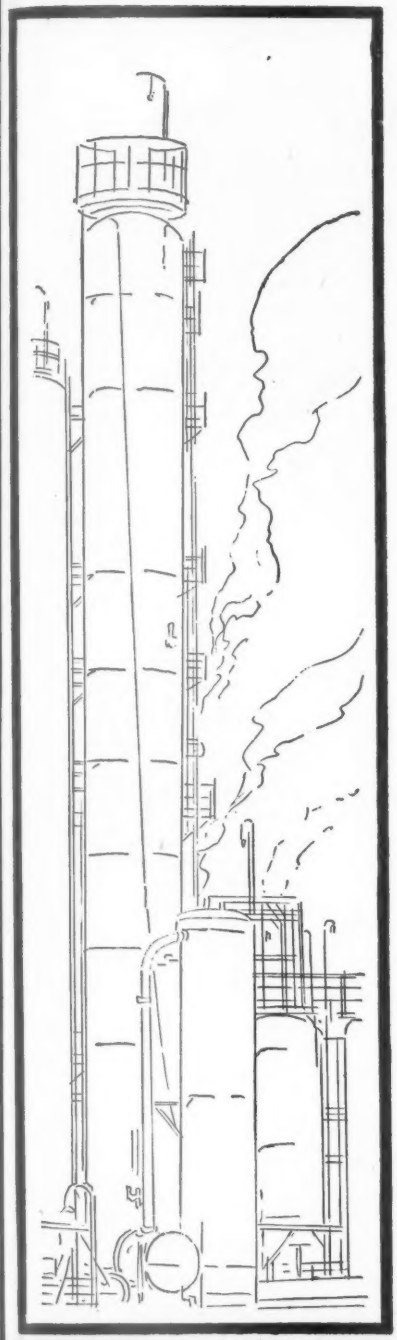


At the time this advertisement is inserted we have finished reconversion on this particular item, and have a full stock in complete size range. Order today.

M. B. SKINNER COMPANY, SOUTH BEND 21, INDIANA, U. S. A.

SKINNER-SEAL PRESSED STEEL ECONOMY CLAMP



STRATCO

PROGRESS.

Stratford cooperates with Industry in research to accomplish new developments—offers the results in the form of technical service and specialized equipment to improve existing processes.

STRATFORD ENGINEERING CORPORATION.

PETROLEUM REFINING ENGINEERS

DIERKS BLDG. KANSAS CITY, MO.

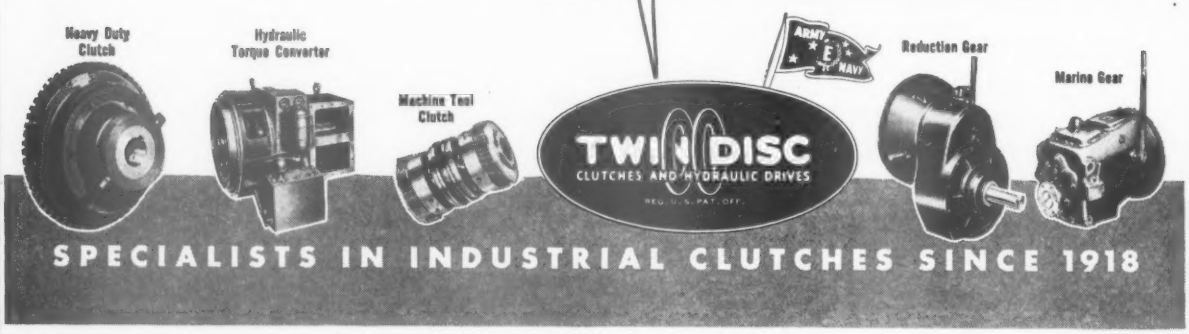
NO ADJUSTMENTS... MAXIMUM CAPACITY

The Twin Disc Model P Air-actuated Clutch offers the operator a greatly simplified maintenance procedure in a wide variety of heavy-duty oil field applications. In the Model P there is no operating mechanism to wear. Since no adjustment is ever required, the clutch always operates at full torque capacity. In addition, the Model P requires no lubrication because oil in the actuating air supply provides adequate lubrication for the air seals.

You will find complete details on these and many other important advantages of the Twin Disc Model P Air-actuated Clutch in Bulletin No. 139. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

At top: Cut-away view of the Model P Air-actuated Clutch. Note the extreme mechanical simplicity and easy access to working parts.

At right: Full view of the Model P. Sizes range from 14" to 36" with capacities from 65 to 990 hp.



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

McKISSICK

Safety TRAVELING BLOCKS

These blocks are safe, sturdy and compact for use in the new smaller rotary units. Streamlined for speed and safety, and manufactured to the high standards of all McKissick Products. Alloy steel sheaves, heat treated for maximum wear on the sheave and wire line, with all grooves machined to line size.

All sizes are furnished to connect to drilling hooks with a rigid joint, or with a lower clevis to carry the top bail on any type or size hook.

Catalog on Request

McKISSICK PRODUCTS CORPORATION

BOX 2496

TULSA, OKLAHOMA

CALL ON CROLOY

for the RIGHT ANALYSES in Tubing for *ANY KIND* of *SERVICE*

CROLOY 1¼	CROLOY 2¼	CROLOY 3 M
Economic grade good creep strength properties. Somewhat more corrosion resistant than the chromium free steels.	*Exceptionally high creep strength* for polymerization and high pressure cracking. Otherwise similar in properties and characteristics to Croloy 2.	Somewhat better creep properties and better resistance to corrosion and oxidation than Croloy 2.
CROLOY 5	**CROLOY 7**	**CROLOY 9**
For operating conditions where corrosion resistance is primary requirement—provides good creep strength and oxidation resistance superior to Croloy 2.	Intermediate steel between Croloys 5 and 9 for operating conditions where corrosion resistance is the primary requirement. Somewhat more oxidation resistant than Croloy 5.	For severe operating conditions where high corrosion and oxidation resistance are essential—suitable for hydrogenation processes.
CROLOY 18-8S	**CROLOY 18-8SCB**	**CROLOY 25-20**
Practically unaffected by extremely corrosive oils at high temperatures. Has high creep strength and high resistance to oxidation.	Similar in properties to CROLOY 18-8S but stabilized with columbium, making it adaptable for welding or heating in carbide range.	For extreme resistance to oxidation and corrosion, for high-pressure, high-temperature services, as in hydrogenation, polymerization, and special heat-resisting installations.

In matching tubes to today's refining and processing operations, B&W Croloys provide you with a complete range of steel analyses from which you can be sure of getting the correct tubing for any specific requirement.

Because performance of Croloy tubing can be predicted in the laboratory with unvarying accuracy, you can depend on it to give long life, dependable service at low ultimate cost on the job.

B&W low and intermediate Croloys have been developed expressly for applications requiring resistance to high temperatures, high pressures, corrosive attack, creep strength and all other adverse conditions. They are in wide use today in refineries, synthetic rubber plants and chemical industries, giving highly satisfactory and economical results.

Among B&W Croloys there is ample selection to assure the best alloy for any given condition. Data on creep strength, tensile strength and other physical characteristics are available to help you determine the tubing best suited for each job. So is the cooperation of B&W engineers. When you call on Croloy, you call on their advice and assistance backed by long experience in successfully solving tough tubing problems.

B&W

Other B&W Products

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Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multi-Fuel Burners • Refractories • Process Equipment.

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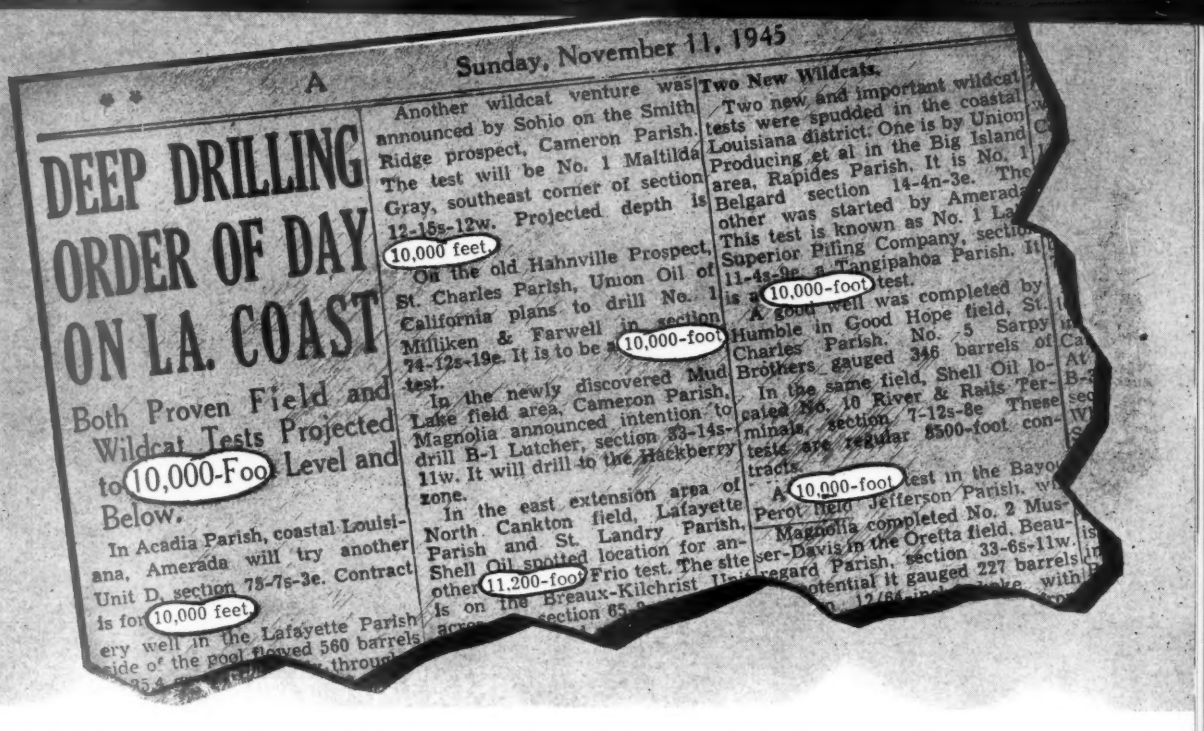
SEAMLESS & WELDED TUBES

THE BABCOCK & WILCOX TUBE COMPANY

WELDED TUBE DIVISION, ALLIANCE, OHIO • SEAMLESS TUBE DIVISION, BEAVER FALLS, PA.

TA-1324



Sunday, November 11, 1945

DEEP DRILLING ORDER OF DAY ON LA. COAST

Both Proven Field and Wildcat Tests Projected to 10,000-Foot Level and Below.

In Acadia Parish, coastal Louisiana, Amerada will try another Unit D, section 78-7s-3e. Contract is for 10,000 feet.

ery well in the Lafayette Parish ide of the pool flowed 560 barrels

Another wildcat venture was announced by Sohio on the Smith Ridge prospect, Cameron Parish. The test will be No. 1 Maltilda Gray, southeast corner of section 12-15s-12w. Projected depth is 10,000 feet.

On the old Hahnville Prospect, St. Charles Parish, Union Oil of California plans to drill No. 1 Milliken & Farwell in section 24-12s-19e. It is to be a 10,000-foot test.

In the newly discovered Mud Lake field area, Cameron Parish, Magnolia announced intention to drill B-1 Lutcher, section 33-14s-11w. It will drill to the Hackberry zone.

In the east extension area of North Cankton field, Lafayette Parish and St. Landry Parish, Shell Oil spotted location for another 11,200-foot Frio test. The site is on the Breaux-Kilchrist Unit section 65

Two New Wildcats.

Two new and important wildcat tests were spudded in the coastal Louisiana district. One is by Union Producing et al in the Big Island area, Rapides Parish. It is No. 1 Belgard section 14-4n-3e. The other was started by Amerada This test is known as No. 1 La Superior Piling Company, sectio 11-4s-9e, a Tangipahoa Parish. It is a 10,000-foot test.

A good well was completed by Humble in Good Hope field, St. Charles Parish. No. 5 Sarpy Brothers gauged 346 barrels of

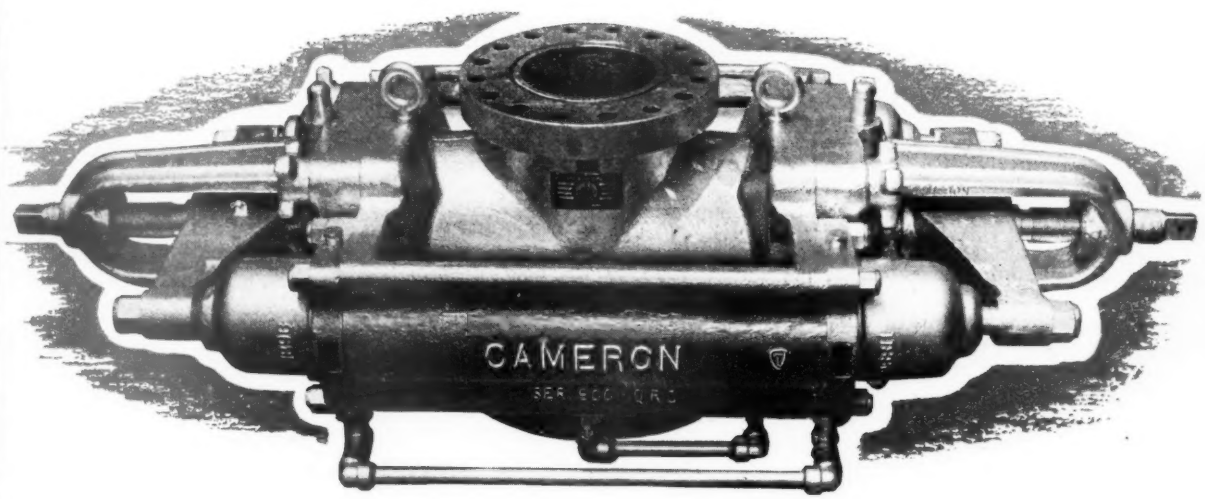
In the same field, Shell Oil located No. 10 River & Rails Terminals, section 7-12s-8e These tests are regular 8500-foot contracts.

A 10,000-foot test in the Bayo Perot field Jefferson Parish, w

Magnolia completed No. 2 Musser-Davis in the Oretta field, Beauregard Parish, section 33-6s-11w. potential it gauged 227 barrels

Get Maximum Protection for Your Deep Drilling Operations...

Get Cameron Type "QRC" Blowout Preventers!



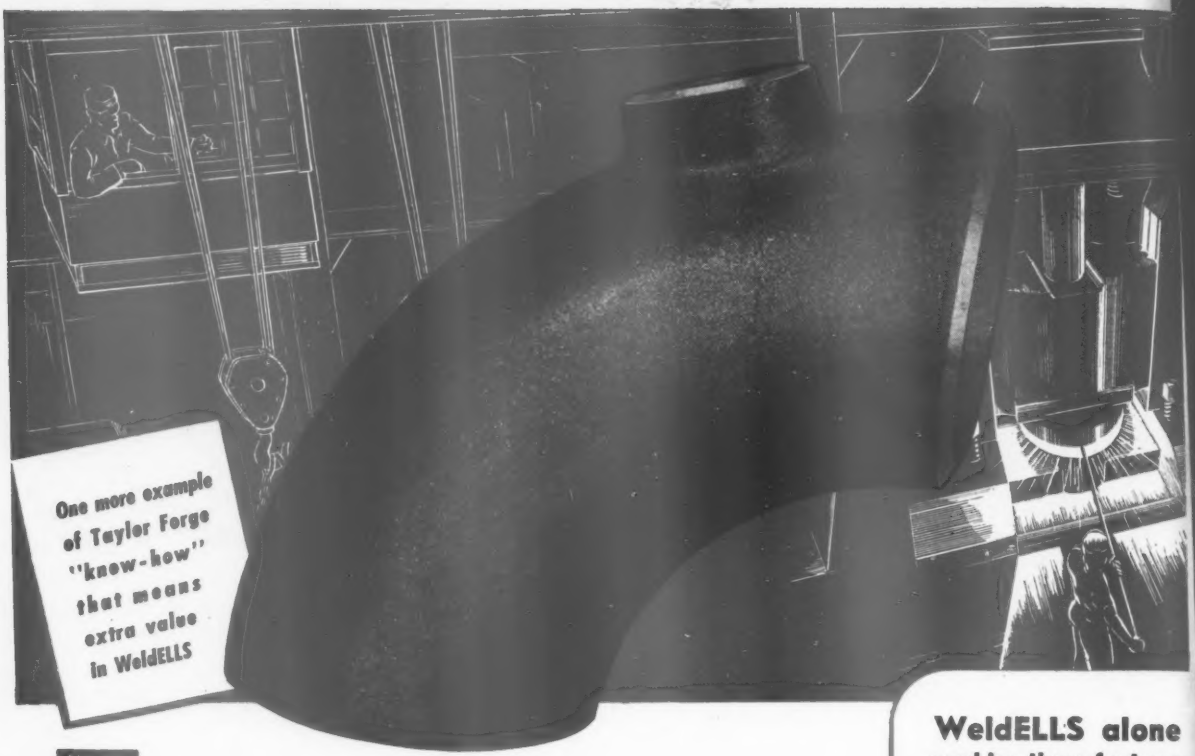
Because of the extremely high pressures usually encountered in drilling today's deep wells and considering the tremendous investment in well bore and machinery required to drill a 10,000-12,000-foot hole, it is sound economy to replace obsolete drilling control units with Cameron Type "QRC" Pressure-Operated Blowout Preventers. For here is the industry's most dependable safeguard against loss of control. It closes swiftly, requiring 1000 pounds closing pressure to seal against 8000 pounds well pressure. Its rams can be changed in a matter of minutes. Patented self-feeding ram packing which has made Cameron blowout preventers famous the world over is a feature of the new unit. Six inch and ten inch sizes are available in both 6000 and 10,000 pound test pressure models. These and many other mechanical improvements are embodied in the "QRC" design.

Complete details will glady be sent to interested operators on request.

CAMERON IRON WORKS, INC.

711 MILBY ST., HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. *California:* The Howard Supply Co., Los Angeles. *Oklahoma:* 310 Thompson Bldg., Tulsa.



There's always another one for us!

★ *Just when we think we've seen everything in special forged fittings another tricky requirement turns up . . . and probably always will. This time it's an order for seven-inch carbon-moly WeldELLS with integrally formed 3-inch outlets in their back walls.*

We have solved problems that are a lot tougher than this, but none exactly like it. Thus, like hundreds before it, it has contributed its share to the sum total of Taylor Forge "know-how" . . . is one more proof that we have honestly earned our reputation for doing things with hot metal no one else does.

THE unduplicated experience of Taylor Forge in the field of special forging has a vital bearing on your choice of standard welding fittings. It means there is nothing to be desired in welding fittings that is not within the scope of the methods and facilities that have grown out of this experience.

By applying these methods and facilities we have given WeldELLS features that are not combined in any other fittings. A good example of this is the uniform strength achieved through proper distribution of extra metal where stresses are higher. Another, is the extreme dimensional accuracy attained by special truing operations. Still another is the special process which forms the tangents, and there are many more.

This specialized Taylor Forge knowledge is responsible for the features listed opposite—is the reason why those who are best qualified to know will agree that

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
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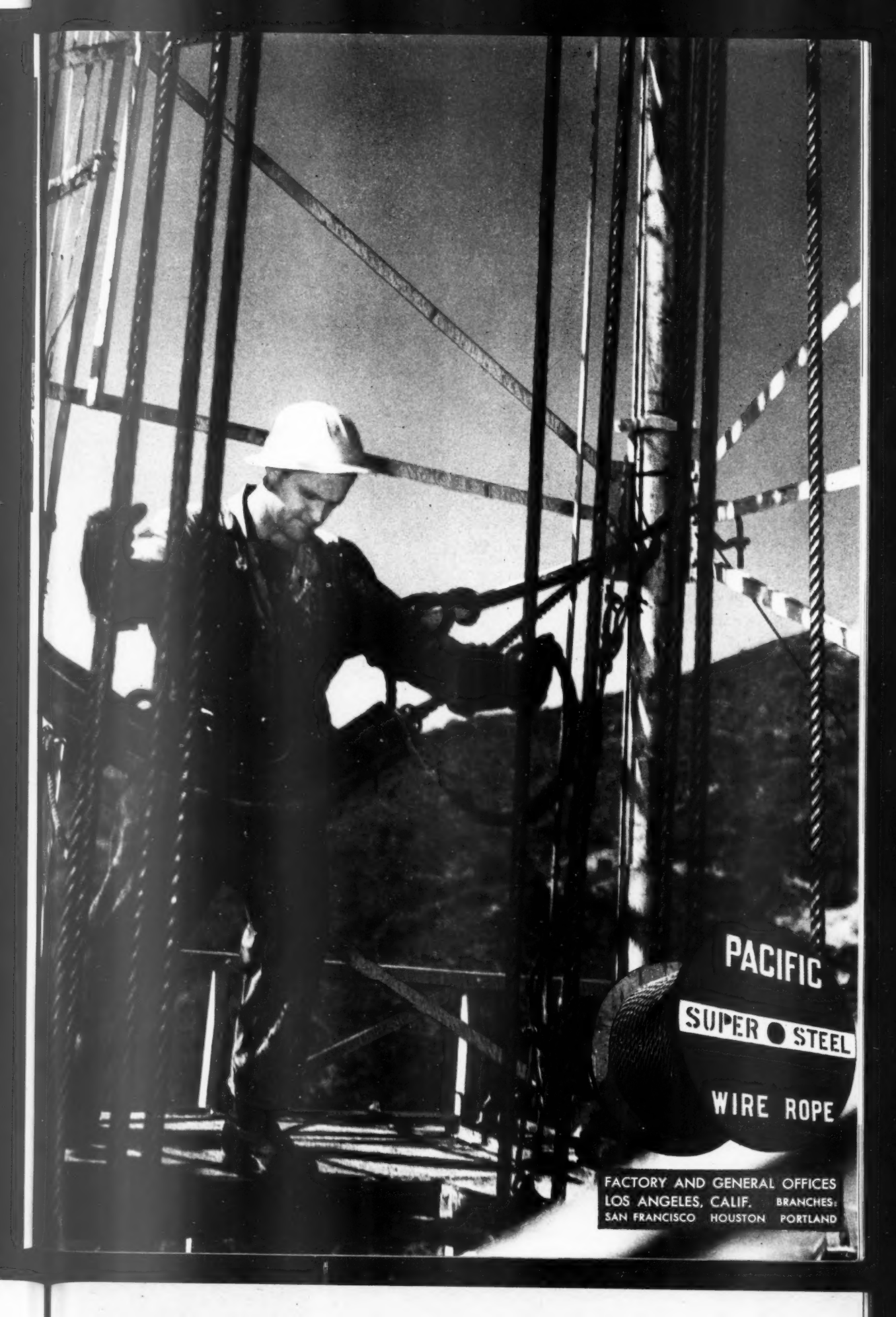
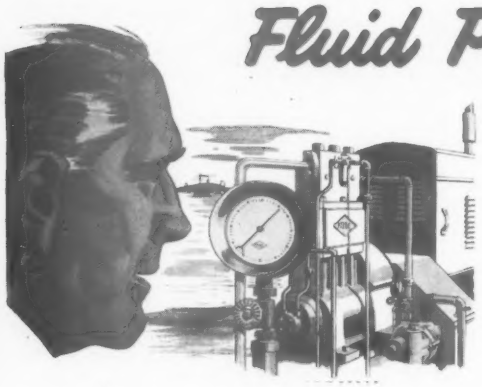

PACIFIC
SUPER STEEL
WIRE ROPE
FACTORY AND GENERAL OFFICES
LOS ANGELES, CALIF. BRANCHES:
SAN FRANCISCO HOUSTON PORTLAND

Fluid Power TELLS HIM...



When you use *Fluid Power* to pump your wells, your pumper doesn't have to tour the lease to know what is happening in each well.

The gauges in the central control plant of the Kobe Hydraulic Pumping System tell him the whole story. They tell him the bottom hole condition of each well . . whether the oil is being pumped steadily . . how fast the pumps are operating . . and most important of all, whether all of the produceable oil is being drawn from each well hooked up to the centralized power unit.

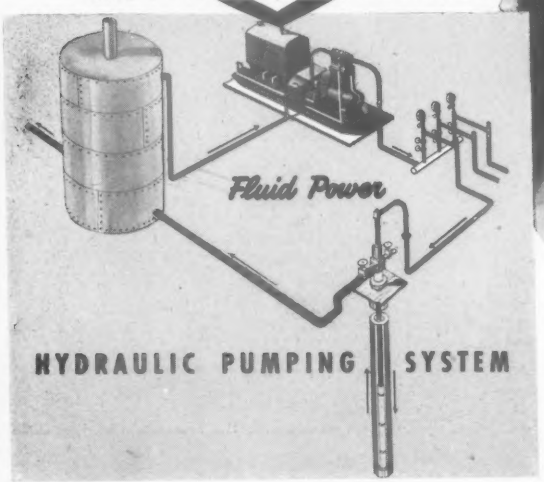
Supplying information of bottom hole pumping conditions is only one of the many advantages offered users of Kobe's Hydraulic Pumping System. The equipment is amazingly flexible. It can be adapted to shallow or deep pumping, and additional wells can be added easily to the central power plant.

Call a Kobe representative today. Ask him to show you how *Fluid Power* can improve your pumping operations.

WHAT GOES ON DOWN HERE!

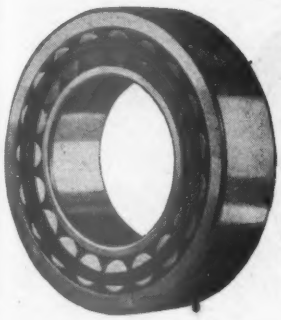
KOBE

ONE OF THE DRESSER INDUSTRIES



PUMP THE MODERN WAY—USE KOBE

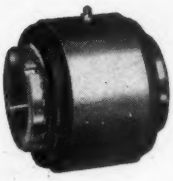
KOBE, Incorporated — *General Offices, Huntington Park, Calif., Division and District Offices: Huntington Park, Calif.; Oklahoma City and Tulsa, Okla.; Brownfield, Dallas, Odessa, Longview, Houston and Wichita Falls, Texas; Great Bend, Kansas; Bakersfield, Calif.; New York, N. Y.*

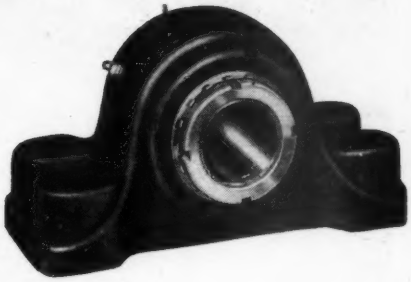


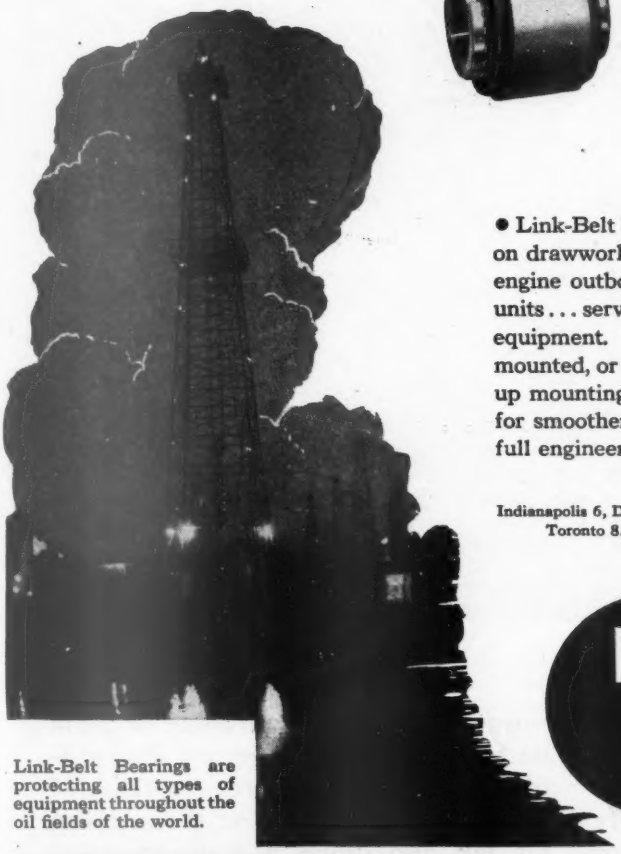
Keeping Oil Industry Equipment

✓ ROLLING SMOOTHER
✓ LASTING LONGER

with LINK-BELT BALL and ROLLER BEARINGS







Link-Belt Bearings are protecting all types of equipment throughout the oil fields of the world.

• Link-Belt Bearings are doing a great job in the oil country . . . on drawworks line shafts, drums and countershafts . . . drilling engine outboards . . . coring reels . . . mud screens . . . utility units . . . service winches . . . cementing pumps . . . transportation equipment. They are available in ball or roller types, unmounted, or mounted in pillow blocks, hangers, flanged or take-up mountings. Specify Link-Belt Bearings in your equipment for smoother, longer service. Send for Data Book 1775-A for full engineering and application data.

LINK-BELT COMPANY

Indianapolis 6, Dallas 1, Houston 2, Kansas City 6, Mo., Los Angeles 33, New York 7, Toronto 8. Offices, factory branch stores and distributors in principal cities.

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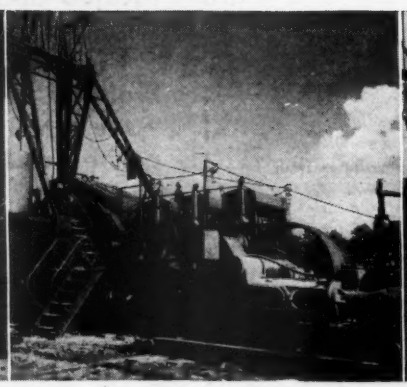
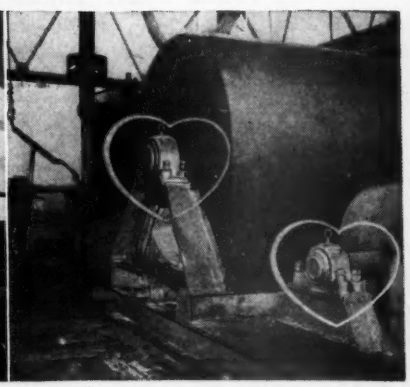
LINK-BELT
BALL AND ROLLER
BEARINGS





GRANT Drilling and Production Tools are the result of more than a quarter of a century of experience in the manufacture of quality oil tools. Their simplicity and extra ruggedness are a guarantee of peak performance and complete dependability. Wherever there are GRANT Tools at work you'll find them doing the job and doing it well—favorites with operators the world over.

For complete details on GRANT Products use the convenient coupon —see the GRANT Section in the Composite Catalog.

GRANT OIL TOOL CO.
2042 EAST VERNON AVENUE,
LOS ANGELES 11, CALIFORNIA.
Please send me, without obligation, complete information on the GRANT Tools checked below

NAME..... TITLE.....
COMPANY.....
ADDRESS.....
CITY..... STATE.....

☐ Bailers ☐ Cleaners ☐ Hole Enlargers ☐ Liner Pullers
☐ Reamers ☐ Shale Bits ☐ Underreamers ☐ Wall Scrapers
☐ Safety Automatic Pressure Releases (Mud Pumps)

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Branches: AVENAL, BAKERSFIELD, SANTA MARIA, VENTURA, CALIFORNIA; ODESSA, TEXAS

WORLDWIDE ACCEPTANCE
because of
WORLDWIDE PERFORMANCE

KINZBACH WHIPSTOCK

The Kinzbach Patented Whipstock has saved time, trouble and money for operators since introduction to the field 19 years ago. It has been constantly improved to meet advanced drilling methods resulting from increased drilling depths. It has changed sidetracking from an emergency measure to a normal well problem.

Through worldwide performance over a long period it is accepted worldwide as the positive means of sidetracking junk, for straightening crooked holes or establishing a new drilling course, for redrilling workover holes, for plugging back holes, and for directional drilling, by orientation.

The outstanding features of the Kinzbach Whipstock are:

1. It can be set at any desired depth, requiring no support from bottom.
2. The hinged feature insures that the top of the whipstock will lie back against the wall of the pipe at all times.
3. By setting in a coupling, the window will always be within the one joint of casing, thereby eliminating all chances of parting the string of casing.
4. Positive setting of slips prevents all turning or downward movement of whipstock at any time.
5. It can be oriented in the hole to mill out in any desired direction.
6. The whipstock can be removed from the hole, if required.
7. It is constructed of alloy steels, and the design is such that a good clean window can be cut, leaving no obstructions for subsequent drilling operations.
8. It can be arranged to trip on bottom, or in internal flush pipe where the pipe end is not exposed, such as welded pipe.

KINZBACH MILLING TOOLS

Kinzbach Milling Tools have been designed to provide the operator with the most efficient tools for the job, and have been proven in the field, assuring a clean, consistent cutting action.

1. The body is made of a high quality steel to a shape that insures the best cutting results, and with the proper size connection for the pipe above the tool.
2. The blades are made of high speed tool steel, and properly heat-treated and ground.
3. The spiral setting of the side blades gives a uniform depth of cut, eliminating much of the danger of twisting off the drill pipe.
4. Since the blades are made as inserts, the cutting edge can be properly ground to provide the most efficient cutting action.
5. These features combine to make the Kinzbach Mills particularly adapted for cutting the new alloy casing and pipe.

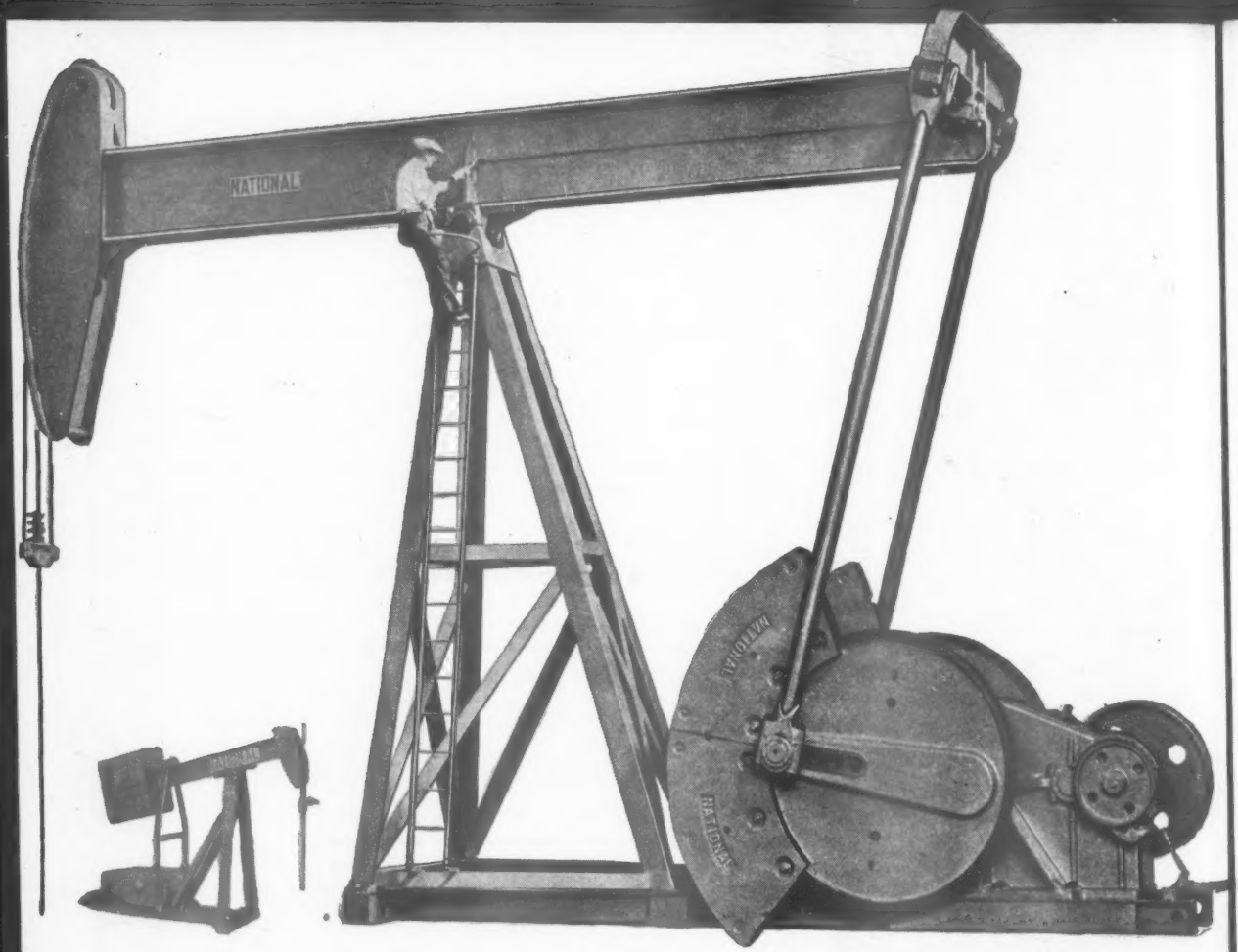
A great many types and designs are either found in our stock, or can be quickly produced to meet the requirements of a specific job. Seven common types are illustrated here . . . types usually carried in stock in the more popular sizes.

SEE THE COMPOSITE CATALOG FOR FULL DETAILS

KINZBACH

NATIONAL

. . . . The Choice That



Comparison of the smallest and largest National Unit Pumpers

THE NATIONAL SUPPLY COMPANY

UNIT PUMPERS

Dictates Pumping Profits

YOU can select your unit pumpers by the haphazard hit or miss method that results in the misfits that are too small or too large —too light or too heavy, or . . .

You can have the counsel of a competent National Supply representative in the selection of the proper pumper to fit your individual requirements from this comprehensive line of National Unit Pumpers:

TU-24G-JD2TP
TU-44G-HD4TP
TU-64G-HD6TP
TU-104G-HD10TP

TU-164G-HD16TP
TU-164-HD16TB
TUS-164-HD16TB

TU-234G-HD23TP
TU-234-HD23TB
TUS-234-HD23TB

TU-304-HD30TB
TU-304-H46TB
TU-304-HD46TB
TUS-304-HD30TB
TUS-304-H46TB
TUS-304-HD46TB

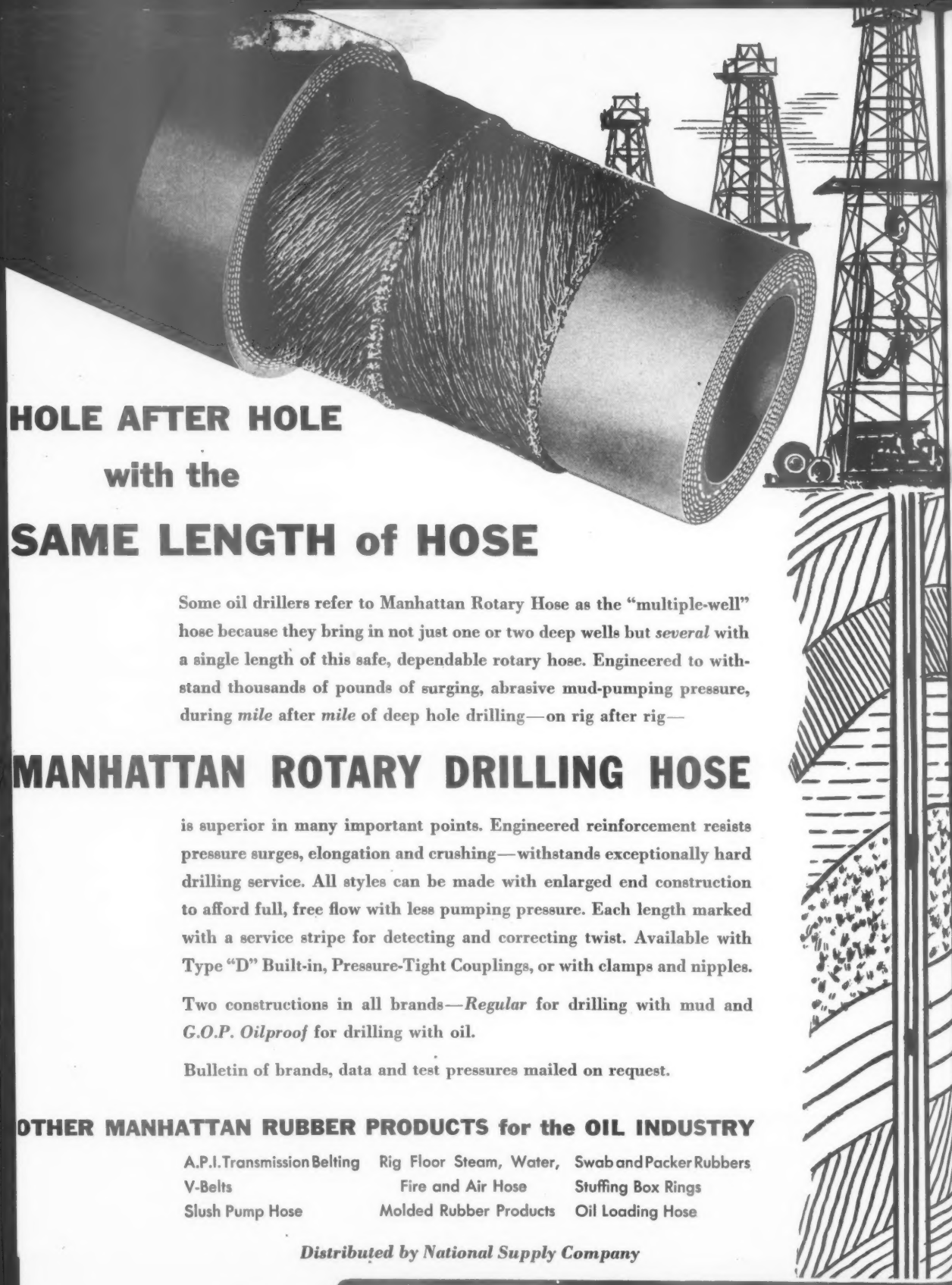
TU-464-H46TB
TU-464-HD46TB
TUS-464-H46TB
TUS-464-HD46TB

TU-654L-H65T
TU-654L-HD65T
TUS-654L-H65T
TUS-654L-HD65T

TU-904L-H90T
TU-904L-HD90T
TUS-904L-H90T
TUS-904L-HD90T

TU-1604-HD160T

General Sales Offices: Toledo, Ohio: Division Offices: Denver; Ft. Worth; Pittsburgh; Tulsa; Torrance.
Export: The National Supply Corporation, 30 Rockefeller Plaza, New York, N. Y., U. S. A.;
River Plate House, 12 South Place, London, E. C. 2.



HOLE AFTER HOLE
with the
SAME LENGTH of HOSE

Some oil drillers refer to Manhattan Rotary Hose as the "multiple-well" hose because they bring in not just one or two deep wells but *several* with a single length of this safe, dependable rotary hose. Engineered to withstand thousands of pounds of surging, abrasive mud-pumping pressure, during *mile* after *mile* of deep hole drilling—on rig after rig—

MANHATTAN ROTARY DRILLING HOSE

is superior in many important points. Engineered reinforcement resists pressure surges, elongation and crushing—withstands exceptionally hard drilling service. All styles can be made with enlarged end construction to afford full, free flow with less pumping pressure. Each length marked with a service stripe for detecting and correcting twist. Available with Type "D" Built-in, Pressure-Tight Couplings, or with clamps and nipples.

Two constructions in all brands—*Regular* for drilling with mud and *G.O.P. Oilproof* for drilling with oil.

Bulletin of brands, data and test pressures mailed on request.

OTHER MANHATTAN RUBBER PRODUCTS for the OIL INDUSTRY

A.P.I. Transmission Belting	Rig Floor Steam, Water,	Swab and Packer Rubbers
V-Belts	Fire and Air Hose	Stuffing Box Rings
Slush Pump Hose	Molded Rubber Products	Oil Loading Hose

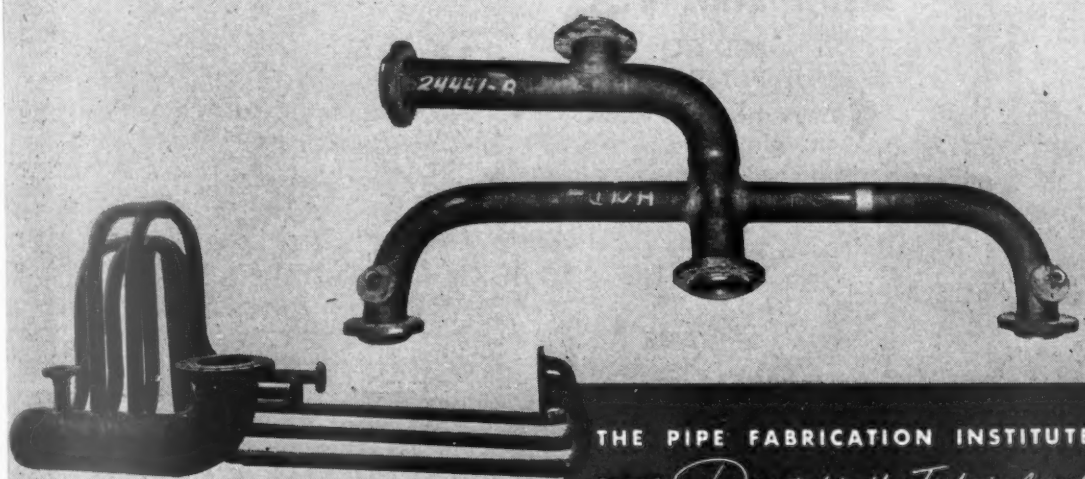
Distributed by National Supply Company

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES AND FACTORIES PASSAIC, NEW JERSEY

Pre-fabricated piping is delivered to the job as a series of subassemblies with all difficult operations performed in the fabricating plant . . . thus facilitating easy, rapid and economical installation. These subassemblies are commercially practical, heat treated and stress relieved when necessary, correctly aligned, thoroughly cleaned, shop tested, and inspected.

Pre-fabricated piping is prepared in plants equipped with considerable special machinery and staffed by highly skilled organizations. Much of this specialized equipment is not readily available in the field. The qualified fabricator has an organization with long and varied experience in the practical possibilities and limitations of piping . . . can frequently contribute suggestions that simplify and improve piping layout, save time and reduce costs.

Pre-fabricated piping has many advantages for the user of pressure piping.



THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

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MID-CO
DRILLING BITS

Designed for Today's Drilling Needs

The records for speed, economy and durability made by the Mid-co Rotary Drilling Bit working under almost every conceivable condition and in practically every known field, have proved their correctness of design as well as their quality of materials and workmanship.

End View of
Solid Type Bit
Illustrating
Blade Construction

Also featuring...

MID-CO
MUD PUMP VALVE

This valve is your assurance of:
Efficient Pump Operation—Long, Continuous Service with less Shut-Down Time and Lower Maintenance Cost.

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MID-CO
CLEAN-OUT BAILER

WORLD-WIDE...
A PLAN THAT WORKS!

from... *Bakersfield to Borneo*
... *Canada to the Argentine*

The thousands of Mid-co BAILERS in use throughout the WORLD—the ACCOMPLISHMENTS of the operators using this OIL WELL CLEAN-OUT TOOL—the inevitable REPEAT ORDERS prove its superiority in Oil Well Reconditioning.

The job to be done NEVER GETS TOO TOUGH for the sturdily built MID-CO CLEAN-OUT BAILER... Manufactured from the BEST MATERIALS obtainable ... Accurately machined and fitted with but one objective — TO CREATE THE MOST EFFICIENT OIL WELL CLEAN-OUT TOOL POSSIBLE.

MID-CO TOOL and SUPPLY CO.
OKLAHOMA CITY, OKLAHOMA

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ALL IN THE DAY'S WORK

A helicopter can easily hover low enough for pilot and passengers to talk with people on the ground nearby. The Kellett XR-8 helicopter, shown above, "stood still in the air" by the hour, at only *one foot altitude*, during its test period. When all was ready, restraining cables were loosed and its cross-country flying career began.

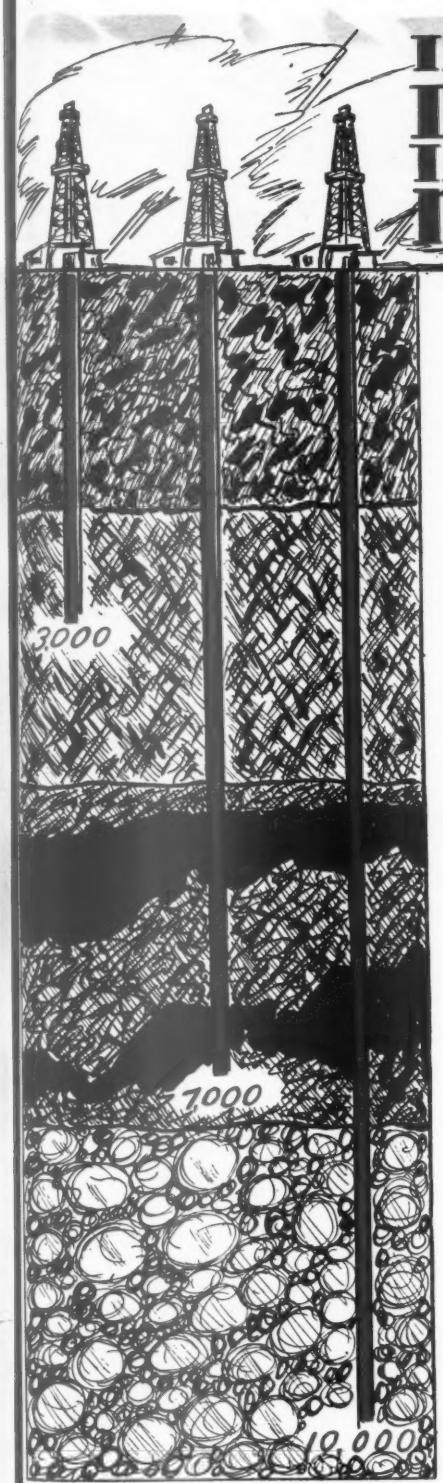
The XR-8 can fly forward, backward or sideways. It can rise or descend vertically, permitting take-offs and landings in any space large enough for safe clearance of its own blades.

Kellett has been active in the design of rotary wing aircraft—helicopters and autogiros—for over 16 years. More advanced models than the XR-8 are on Kellett drawingboards and in Kellett workshops today.

The final word in helicopter design will not be written for some time to come. Many engineering problems must be solved before helicopters are brought into practical daily use. Progress already achieved, however, more than justifies the man-hours that must still be spent by Kellett and other organizations active in this field. Their objective is to make helicopters available for exacting travel and transport jobs, in areas and under conditions where no other air, land or water craft can operate.

Kellett Aircraft Corp., Upper Darby (Philadelphia), Pennsylvania.

KELLETT



The Deeper the Well The More You Save!

When You USE the NIXON SURFACE CONTROL GAS LIFT to Produce Your Oil

Yes indeed. Here is something to remember about pumping deep wells. When you are producing from 7000 to 10,000 feet — the percentage of increase in cost of equipment when you use the Nixon Surface Control Gas Lift is much smaller than that called for with sucker-rod equipment.

The cost of surface equipment of the Nixon Gas Lift remains the same — regardless of depth — the only increase in cost for increased depth being that of additional valves and additional wire line.

And remember — many Nixon Gas Lifts have been operating five years without ever pulling the tubing.

To cut lifting costs and increase profits use The Nixon Gas Lift.

See your nearest WILSON supply store or write

WILSON SUPPLY COMPANY

1412 MAURY ST., HOUSTON, TEXAS

SALES OFFICES: Tulsa, Oklahoma; Dallas and San Antonio, Texas.
LOS ANGELES: Western Pressure Control, 5700 Santa Fe Ave
TRINIDAD, B.W.I.: Neal Massey Eng. Corp.

BRANCH STORES: TEXAS—Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport. ARKANSAS—Magnolia. MISSISSIPPI—Natchez.

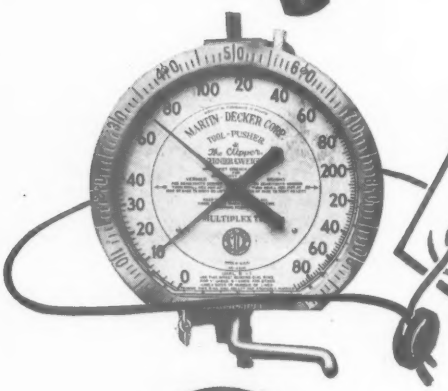
SEALED

FOR GREATER ACCURACY and SERVICE

There's no pumping up . . . no adjusting . . . no leaks. The fluid system is factory loaded and permanently sealed—fluid remains in the unit even during transportation and storage. Installation is fast and fool proof—accuracy is guaranteed.

The "Sealtite" Drilling Control

The master recording instrument for every job where you want complete control of all drilling factors. Indicates and records weight, mud pressure, torque and shows rotary table speed. Illuminated for easy night reading. Has capacity to handle 20,000-foot wells. Gauge readings are smooth, sensitive, always accurate.



The Clipper "Sealtite" Weight Indicator

A portable weight indicator for ordinary drilling or production work. "Sealtite" construction combines factory calibrations and elimination of the possibility of leaks with maximum portability. Has vernier gauge for extremely sensitive weight control when fishing, milling, etc.

The Unitized Mud Pump Gauge

Accuracy, sensitivity and smooth, easy readings make this the ideal portable gauge for measuring slush pump pressures. Mechanism runs in an oil bath, eliminating rust or corrosion. Large numerals stand out clearly from 30 feet or more, and readings can be made by simply noting position of gauge hand. Vernier retard movement covers both low and high pressure ranges. "Unitized" is available in one, three or five thousand pound capacities.

HOME OF THE WEIGHT INDICATOR

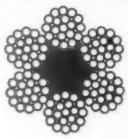
MARTIN DECKER CORP.

LONG BEACH, CALIFORNIA

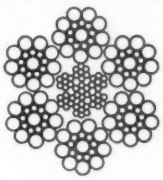
SAN JOAQUIN VALLEY: T. J. CULLEN, BAKERSFIELD, CALIFORNIA
MID CONTINENT DISTRIBUTOR: REED ROLLER BIT COMPANY, HOUSTON, TEXAS

WHAT LENGTH *Wire Rope* DO YOU NEED?

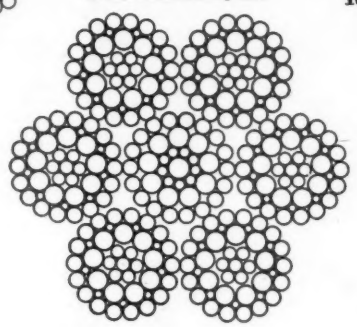
¾ in. diameter Rope—up to 60,000 ft. in one piece.



1 in. diameter Rope—up to 40,000 ft. in one piece.



2 in. diameter Rope—up to 10,000 ft. in one piece.

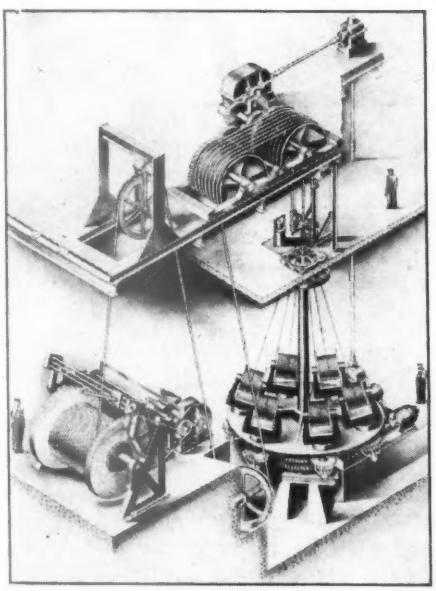


Wire Rope for any purpose and in any length, standard or Union-formed, (*Pre*formed) is available from Union Wire Rope's modern plant. Here fabrication of Wire Rope is a matter of precision and craftsmanship, from the laboratory that selects the correct steel for each type of rope to the closing machines that wind it into its final form.

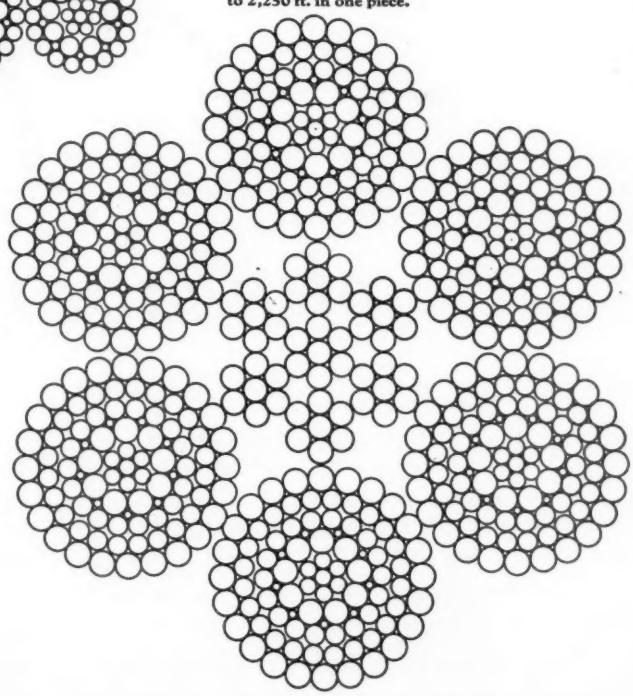
One giant closing machine, shown below, has a capacity of 27 tons of rope, laying rope, from ¾ inch to 4 inches in diameter. This machine, designed by Union Wire Rope engineers lays continuous lengths of Wire Rope, such as a 4 inch diameter rope, weighing 27 lbs. per ft. Union Wire Rope distributors and field engineers are ready to assist you in selecting the right Wire Rope for your requirements—in strength, flexibility, size, construction and length.

UNION WIRE ROPE CORPORATION
2102 Manchester Avenue
Kansas City 3, Missouri

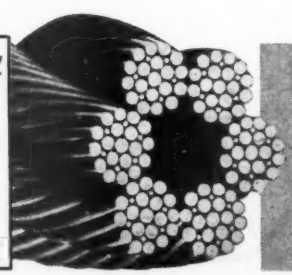
Union Wire Rope's giant closing machine stands four stories high and has capacity for laying rope from ¾ inch to 4 inches in diameter.



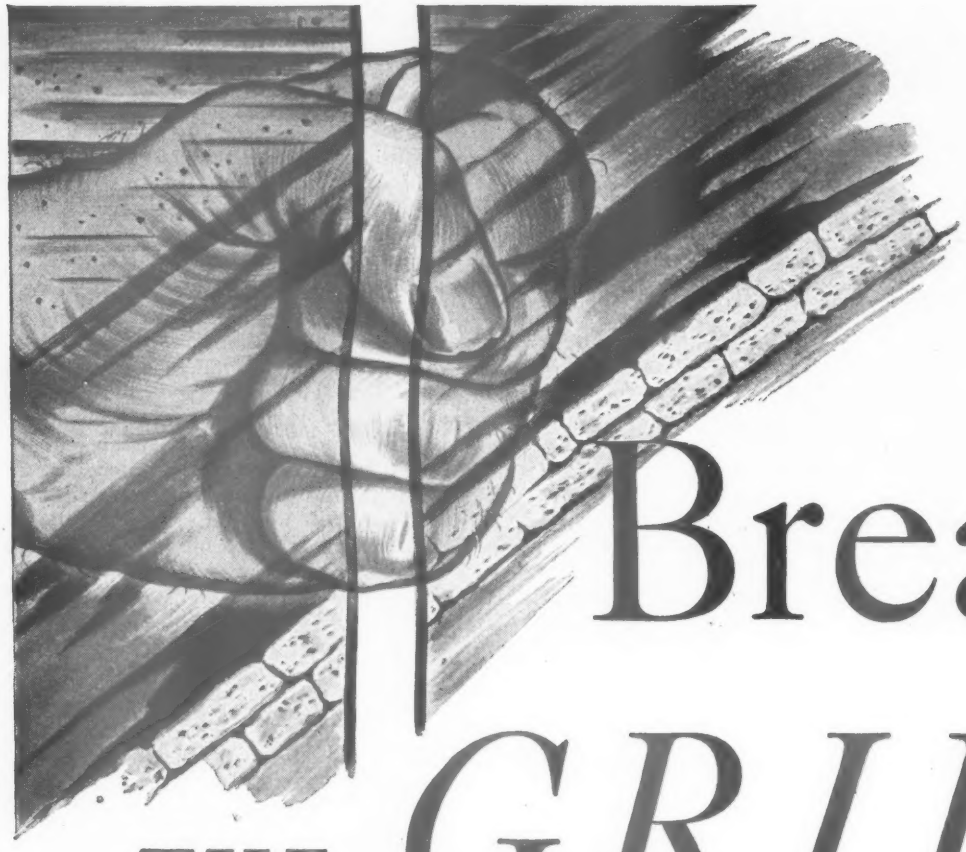
4 in. diameter Rope—up to 2,250 ft. in one piece.



Every Wire—Every Strand of
union-formed
(*Preformed*)
Wire Rope
PULL TOGETHER... TO WEAR LONGER!



union *Wire Rope*
"UNION-FORMED IS PREFORMED"



Break THE GRIP of heaving shale....

LIKE the hand of a giant, heaving shale "freezes" the drilling string, bringing operations to a standstill. At the best it delays operations, greatly increasing costs. At the worst it forces the abandonment of potentially profitable drilling operations.

Yet heaving shale *can* be controlled, as many leading oil companies have proved. By checking hydration and keeping the shale strata stable, Texaco's Sodium Silicate method of heaving shale control has permitted the successful completion of many wells in areas where heaving shale has been a costly and sometimes insuperable obstacle.

The Texaco Sodium Silicate method is now being used by many major oil companies in the Gulf Coast Area. It has proved an important aid in bringing in oil that America needs.

TEXACO DEVELOPMENT CORPORATION

A Subsidiary of The Texas Company

When you need SAFETY or RELIEF VALVES you don't want...

FARRIS Safety Valve No. 2175. Full nozzle port, high lift, high capacity. Steam Separator Bell. For pressures to 600 lbs. at 750° F. Sizes ¾" to 6". Over-size outlet.

FARRIS Vapor or Liquid Service Valve No. 1775. For pressures up to 600 lbs. Sizes ¾" to 6". Enclosed spring, high lift, full port capacity. Available with pressure-tight cap; test lever; pop action.

Peacetime projects are already shifting into high gear to provide more employment . . . quicker reconversion . . . earlier sales. FARRIS Valve engineers and builders are always geared to fast—but *precision*—valve production . . . and fast deliveries. We can't slow down—the demand for FARRIS Valves won't let us!

So, if you're trying to get the jump on your competitors through early production, early sales, early profits—and if you need a Safety or Relief Valve . . .

ask for a FARRIS!

When you specify a FARRIS Safety or Relief Valve you'll get GOOD DELIVERY — *and a lot more!*

- **You'll get a dependable valve, with every finished surface precision machined . . . for precision operation in the protection of your equipment.**
- **You'll get "precision alignment" of spring, stem, disc, guide, and seat . . . for reliable, trouble-free performance.**
- **Your FARRIS valve will have fewer parts . . . for reduced risk of failure.**
- **And it will have sturdy construction, with materials of superior strength and durability . . . for grueling service and long life.**

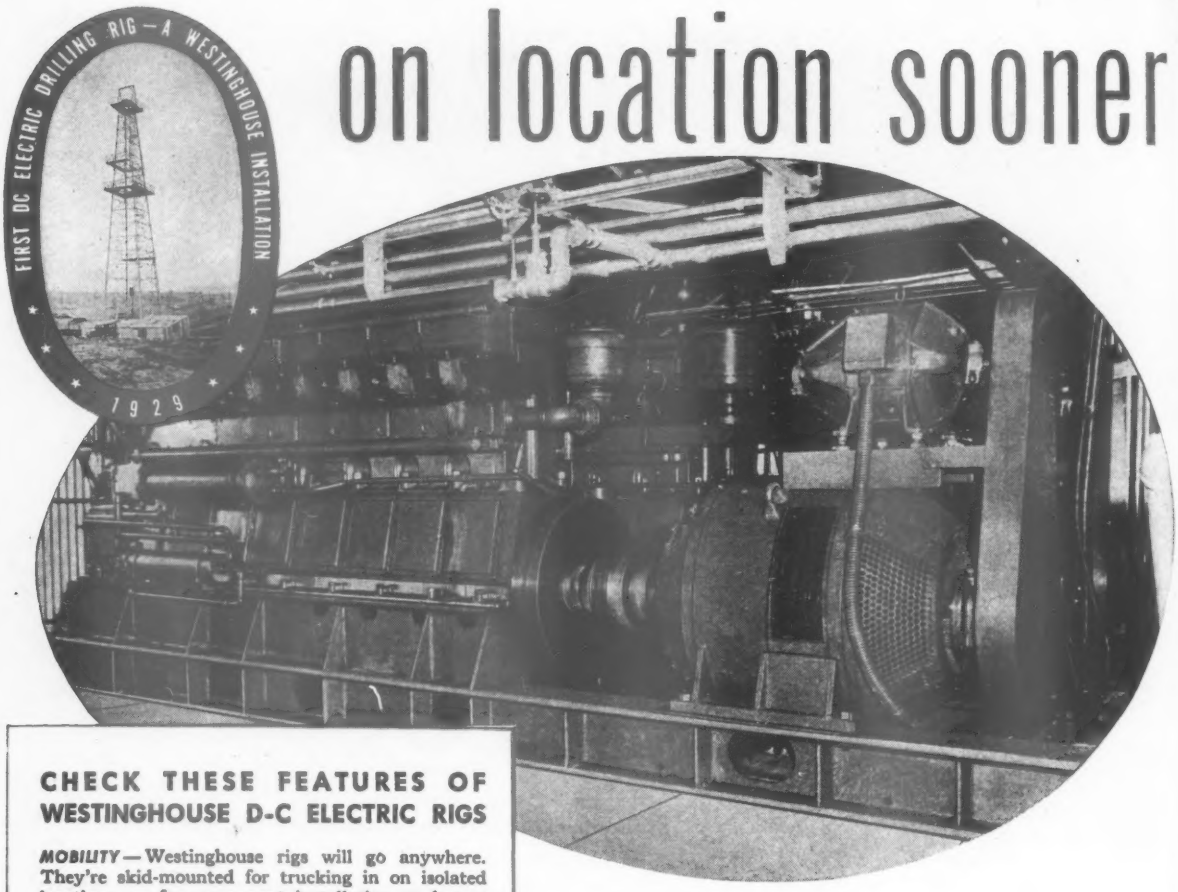
Farris

SAFETY and RELIEF VALVES

Among the complete lines of FARRIS Safety and Relief Valves there must be the very valve you need — or we'll custom build one to meet your particular requirements! Why not write today for our Bulletin?

FARRIS ENGINEERING CO., 372 Commercial Ave., Palisades Park, N. J.

on location sooner



...WITH WESTINGHOUSE ELECTRIC DRILLING RIGS

Mobility—that's why you can be on the new location sooner with Westinghouse electric rigs.

They're light—easy to handle—skid-mounted. Truck them to isolated locations, mount them on trailers or barges—they'll go *anywhere*. The complete electric rig is made up of a number of small, compact units, quickly moved. The use of Class B insulation reduces the size and weight of electrical equipment. The use of direct-connected, high-speed generators provides a compact, simple power unit—easy to handle.

Westinghouse electric rigs are the result of years of *actual rig and field experience*. The first Diesel-electric drilling rig was built by Westinghouse in 1929. Since then we've built more than forty d-c rigs, and we've had experience on every type—from the simple single-generator, semi-electric rig to the modern multiple-generator, full-electric rig.

Whether you use rotary rigs for deep or shallow wells—wildcat or proved lease drilling, Westinghouse experience will pay off in more hole, *faster*, at less cost. For complete information, call your nearest Westinghouse representative, or write for Booklet 3038. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-94675

CHECK THESE FEATURES OF WESTINGHOUSE D-C ELECTRIC RIGS

MOBILITY—Westinghouse rigs will go anywhere. They're skid-mounted for trucking in on isolated locations, or for permanent installation on barges or trailers. Units are light—easy to handle.

FLEXIBILITY—When the power is transmitted through electric cables, you can locate your power plant and slush pits, relative to the derrick floor, to meet any condition—no time lost in adapting rig to a new location.

EASE OF INSTALLATION—Electric drilling rigs are ready to go, almost as soon as they're hauled in on the lease—connect flexible power cables, and plug in foolproof control circuits.

SMOOTHNESS OF OPERATION—Electric control gives smooth, fast load pickup—with no engine stalling. Full power for hoisting—or drilling—is instantly available through pushbutton control at the draw-works.

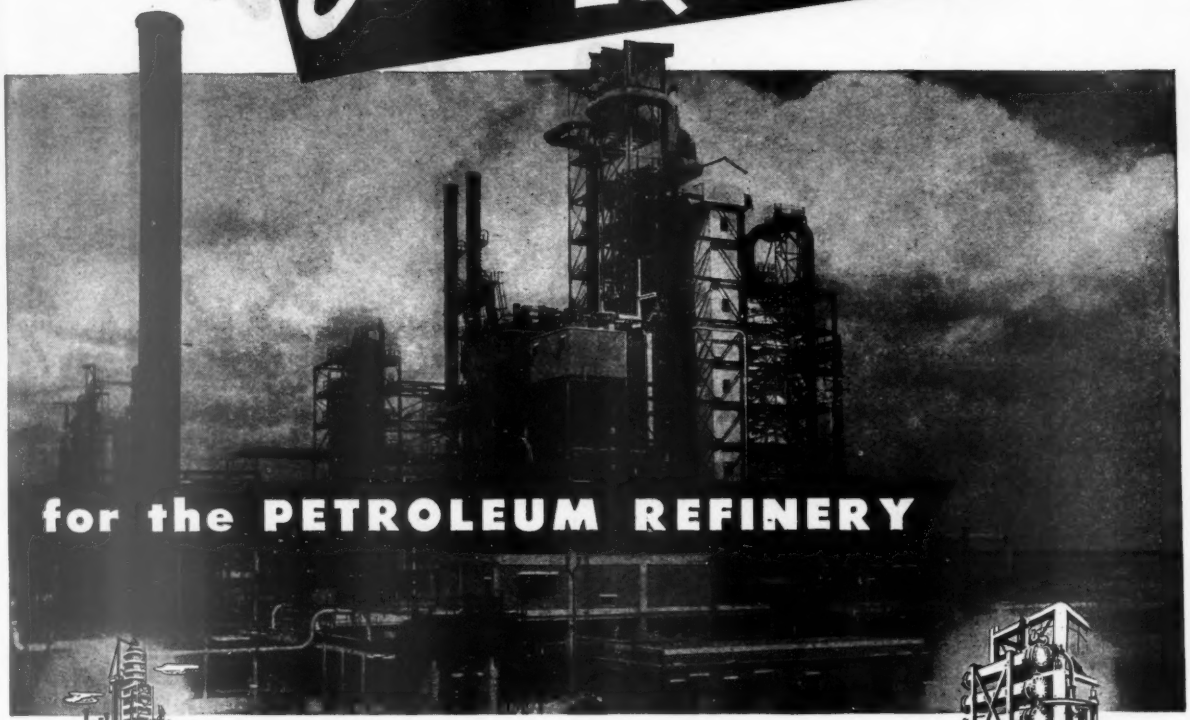
ECONOMY—Drilling costs you less per foot of hole with Westinghouse electric rigs—you save setup and drilling time. You'll save on maintenance costs, too, with reliable, economical drive.

EXPERIENCE—Since 1929 Westinghouse has built over 40 d-c electric rigs—and has had actual rig and field experience on every type—cable tool or rotary, deep or shallow drilling, a-c or d-c power.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

ELECTRICAL EQUIPMENT FOR THE PETROLEUM INDUSTRY

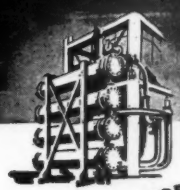
Essential EQUIPMENT



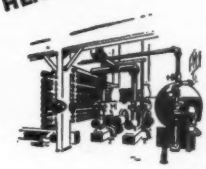
TOWERS—STILLS

STEAM BOILERS

DROP FORGED STEEL VALVES AND FITTINGS



HEAT EXCHANGERS



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WAX PLANT EQUIPMENT

REMODERNIZATION is a *must* for many refineries in order to stay in the profitable production bracket of the post-war era!

Select the process most suitable to your operating conditions and indicated future market requirements and then specify . . . Equipment by Vogt. A skilled operating personnel and exceptional manufacturing facilities assure the best in quality workmanship for the wide variety of process equipment we construct to all Codes.

Remember — Vogt will design and build it . . . better!

HENRY VOGT MACHINE CO., Inc.

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NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Tame the Pressures...
TYPE "KV-30" CONTROL HEAD PACKER
Especially designed for the most severe packer applications encountered in exceptionally deep wells. Also available as Type KV-8 with 8" valve opening and Type K without the control head feature. All three types available for 5½", 5¾", 6", 6⅝" and 7" casing.

..of deep well production!

STRONG AND STURDY... built to tame the terrific pressures encountered in the deepest wells, Guiberson's KV-30 Control Head Packer assures positive control at all times. Its rugged strength has been proven in the field. Designed to support 20,000 feet of 2½" upset tubing. The packer has a very large packing medium with reinforced ends, laboratory tested against differential pressures as high as 10,000 pounds per square inch. Control valve has two sealing mediums... a special Neoprene sleeve plus the conventional ground seat. Extra long 30-inch valve opening eliminates all nozzling effect, and removes all risk of changing the set position of the packer when opening and closing the valve. When the KV-30 is set, it stays set; yet it can be reset quickly and easily... higher or lower... or pulled without swabbing effect. For positive control at all times under the tough conditions of deep hole production the KV-30 gives extra strength, extra safety, and extra service.

Producers of oil field tools, steel cabinets, domestic oil heaters, sheet metal products and molded rubber products.

Guiberson U.S.A.

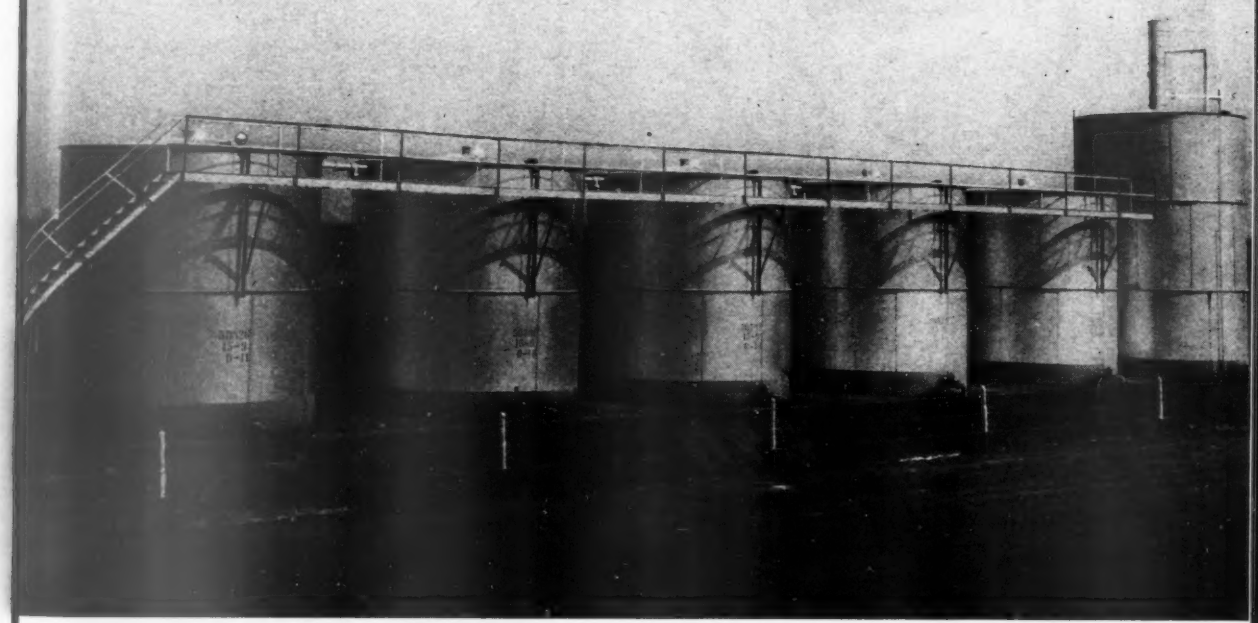
THE GUIBERSON CORPORATION

ESTABLISHED 1919

Dallas, Texas

SAFETY HAM SOMOS GUIBERSON BUILT REG. U. S. PAT. OFF.

YOUR OIL DESERVES THE *Quality* OF PARKERSBURG TANKS



The effort and cost of drilling and producing crude definitely justifies the best available protection it can have above ground. Parkersburg bolted steel tanks have been furnishing that brand of protection since most present-day producers can remember. Thanks to engineering research, careful selection of materials, skilled workmanship, a company-owned erection service and nearly half a century of fabricating experience, the genuine quality of Parkersburg lease storage is not questioned by men who know storage problems. The longer a Parkersburg tank battery is required to stay in service the greater the dividend on the original investment becomes. Trouble-free service after years on the job is where Parkersburg Quality really counts.

THE PARKERSBURG RIG & REEL CO.

PARKERSBURG & OCS PRODUCTS

GENERAL OFFICES, PARKERSBURG, W. VA.

Plants at Parkersburg, W. Va., Coffeyville, Kan.

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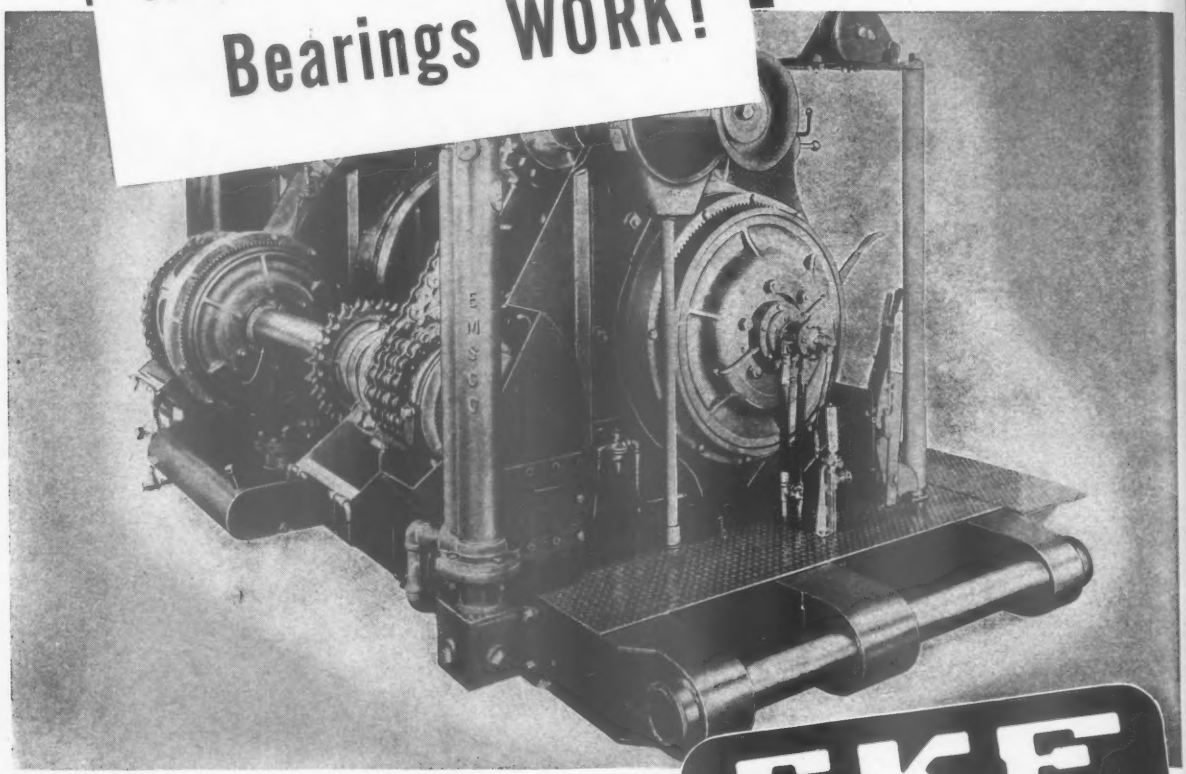
OCS

PARKERSBURG

Where 6 SKF Bearings WORK!



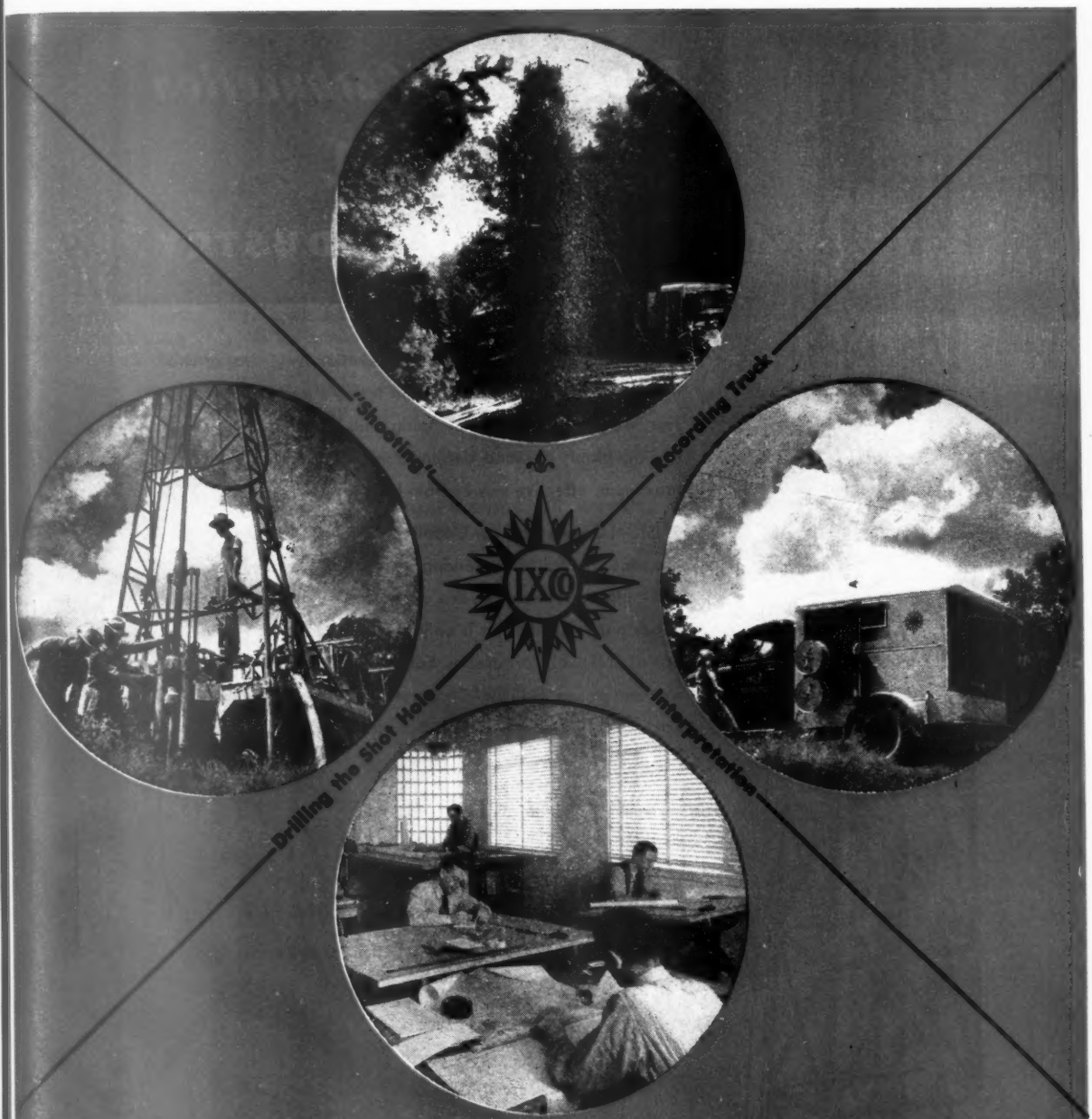
● *Built by* EMSCO DERRICK & EQUIPMENT CO.

Enter the heart of oil well drilling where this Type J-1000 Draw Works is used for drilling wells to 10,000′, and you'll find 6 SKF Spherical Roller Bearings on the job. You'll find their self-aligning construction insuring an even distribution of heavy loads on each set of rollers. You'll find them needing no adjustments in year after year of rugged service. You'll find them bringing maintenance costs down and *keeping them down*. In the steady production of oil, bearing performance is the one thing that counts. 5886

SKF INDUSTRIES, INC., PHILA. 34, PA.

SKF
BALL AND ROLLER BEARINGS

DE

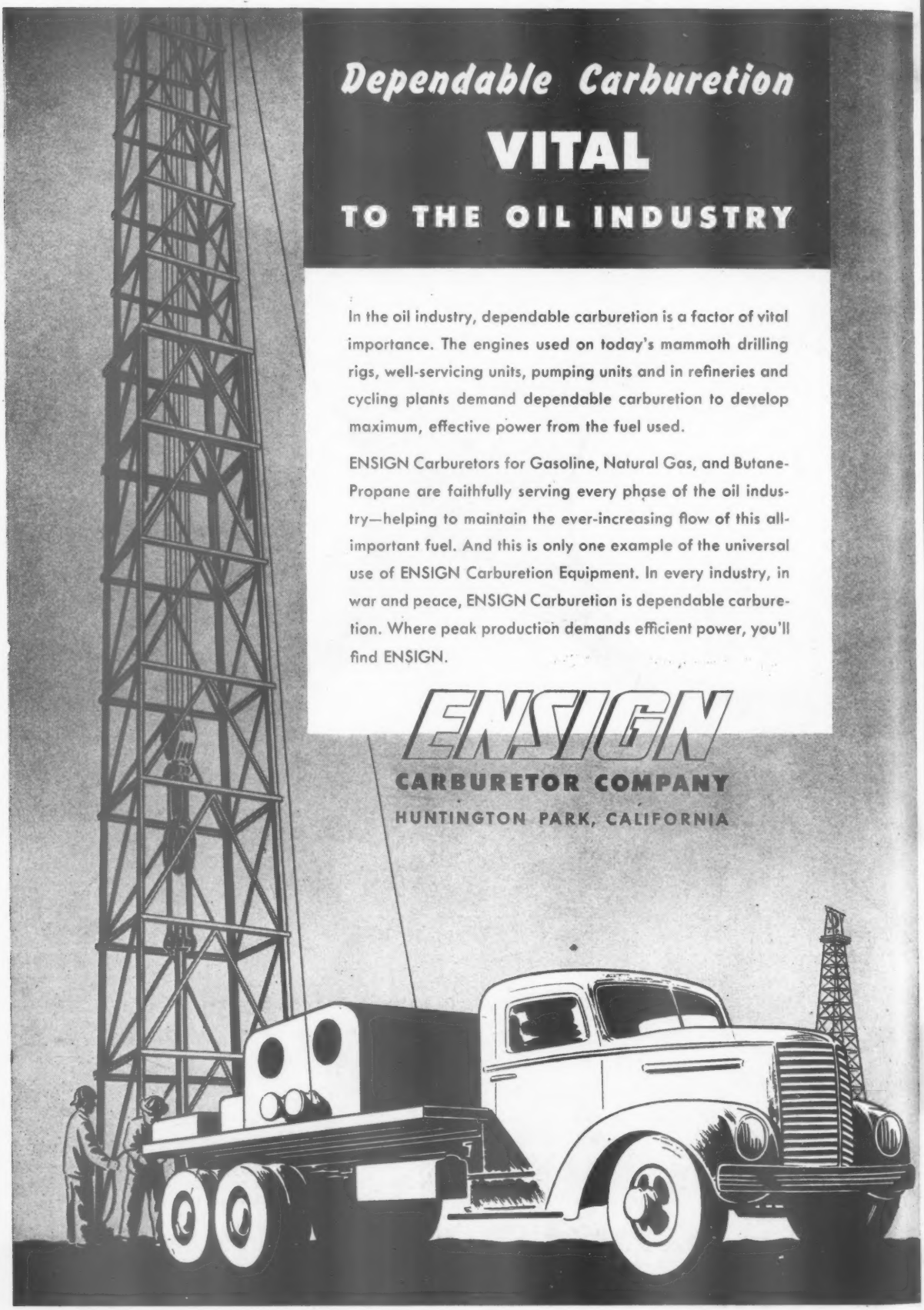


AT INDEPENDENT you will find the experience, the facilities, and the "know how" that produce accurate, reliable, profitable results from your seismograph exploration work. Inquiries are invited.

Independent
EXPLORATION COMPANY

Geophysical Surveys

901 Esperson Bldg. Houston, Texas



Dependable Carburetion

VITAL

TO THE OIL INDUSTRY

In the oil industry, dependable carburetion is a factor of vital importance. The engines used on today's mammoth drilling rigs, well-servicing units, pumping units and in refineries and cycling plants demand dependable carburetion to develop maximum, effective power from the fuel used.

ENSIGN Carburetors for Gasoline, Natural Gas, and Butane-Propane are faithfully serving every phase of the oil industry—helping to maintain the ever-increasing flow of this all-important fuel. And this is only one example of the universal use of ENSIGN Carburetion Equipment. In every industry, in war and peace, ENSIGN Carburetion is dependable carburetion. Where peak production demands efficient power, you'll find ENSIGN.

ENSIGN

CARBURETOR COMPANY

HUNTINGTON PARK, CALIFORNIA

"ALL SERVICE" MEANS ROTARY WORK TOO

Franks Telescoping Derrick All Service Unit Is Versatile

Franks ALL SERVICE units completely truck mounted with telescoping derrick that folds over truck for moving are designed to permit the use of a rotary attachment for general rotary well work over, deepening, tailing-in, or straight "slim-hole" or standard drilling . . . all in addition to its basic function as a general rod, tubing and general servicing unit.

Rotary accessories and components available as extras include: Franks Improved Rotary Table; Propeller Shaft Rotary Drive and Rear-End Rotary Countershaft; Swivel; Kelly and Couplings; Table Bushings; Rotary Hose; Hook; Traveling Block and Pump.

Write for complete details on Franks various All Service Units for handling shallow to 10,000 ft. wells.

Franks Model 3000 Double Drum All Service Unit with 84 ft. telescoping derrick, which has been in service since 1940.

FRANKS REPRESENTATIVES:

Main Office Box 3218, Tulsa, Oklahoma, U.S.A.

Export: A. V. Simonson, 149 Broadway, New York, N. Y.

California: Hillman-Kelley, Inc., 1000 Macy Street, Los Angeles

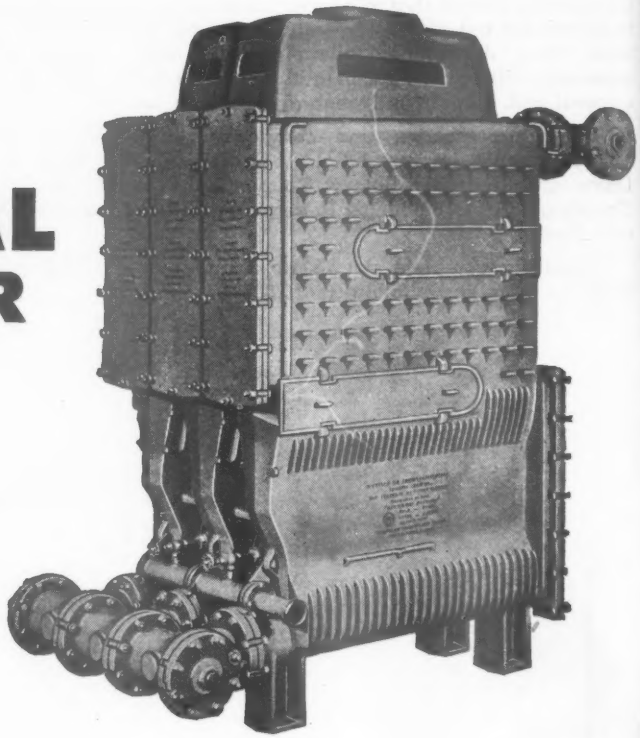
Texas, Louisiana, New Mexico: R. M. White, 823 Neil P. Anderson Bldg., Fort Worth, Texas

Rocky Mountain: Industrial Power Units, Inc., Box 152, Casper, Wyo.

REDUCE YOUR HEAT-TREATING COSTS ON VISCOUS PRODUCTS

with the

NATIONAL OIL-RATOR



- Economical first cost
- Lower maintenance
- Variable capacities

The uses of the National Oil-Rator are not restricted to the handling of crude oil emulsions. This cast iron, corrosion-resisting, gas-fired boiler solves many other problems in the Chemical and Refining industries. Weatherproof and easy to clean, the National Oil-Rator can be kept in continuous service during the repair or replacement of individual parts and sections.

ENGINEERING

SERVICE

Phone or write for the aid of a National Engineer — without obligation. ★ ★ ★

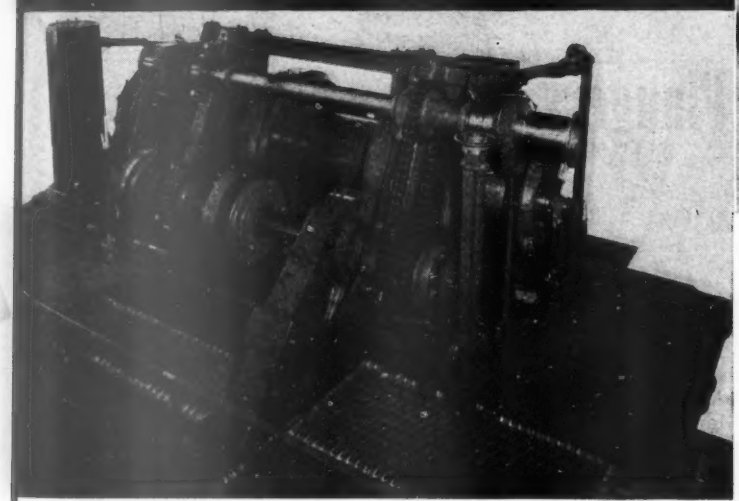
INDUSTRIAL DIVISION

The NATIONAL RADIATOR Company

JOHNSTOWN, PENNSYLVANIA

For the Deep Jobs...

EMSCO J-1250
POWER DRILLING RIG



Shown above is the Type J-1250 Drawworks, rear view from Driller's side, with guards removed.

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
EXPORT DIVISION
30 Rockefeller Plaza New York City, N. Y.
Representatives
MEXICO - ARGENTINA - ENGLAND - TRINIDAD - BRAZIL

Designed for the deepest drilling, the Emsco J-1250 Drilling Rig has little increase in weight and no sacrifice in safety factors over units of shallower depth ratings. There is no general use of more massive parts. It incorporates disc-type, air operated friction clutches, has 6 hoisting speeds, 3 rotary speeds, 2 reverse speeds to the drum shaft and 1 to the rotary. Its narrow width facilitates transportation.

The J-1250 is a smooth, easily handled and efficient drilling rig with many new features . . . the result of careful engineering detail plus the high quality of materials and workmanship common to Emsco equipment.

CONTINENTAL

"KOSMOS" Porcelain Plungers

• A long-time user writes us enthusiastically about savings resulting from "KOSMOS" Porcelain Plungers installed in his pumps. Claiming the "worst" pumping conditions, he further states: "now we have no trouble whatever with packing".

Highly abrasion and corrosion resistant, the porcelain becomes smoother the longer it is in operation. Only finger-tight adjustment of stuffing boxes is necessary to prevent leakage. The small coefficient of friction is continuously reflected in lower power requirements and savings from increased plunger and packing life, increased efficiency and reduction in time out for repairs are realized on practically all services, whether for clear water, oil, gasoline, gritty materials or chemicals.

Experience in many pumping applications shows that remarkable results may be obtained by using "KOSMOS" Porcelain Plungers. There is a size for practically every pump, ranging from 1¾″ to 16″ in diameter and from 8″ to 48″ in length. They are suitable for pressures up to 2000 psi and withstand corrosive or abrasive action at temperatures up to 150° F.

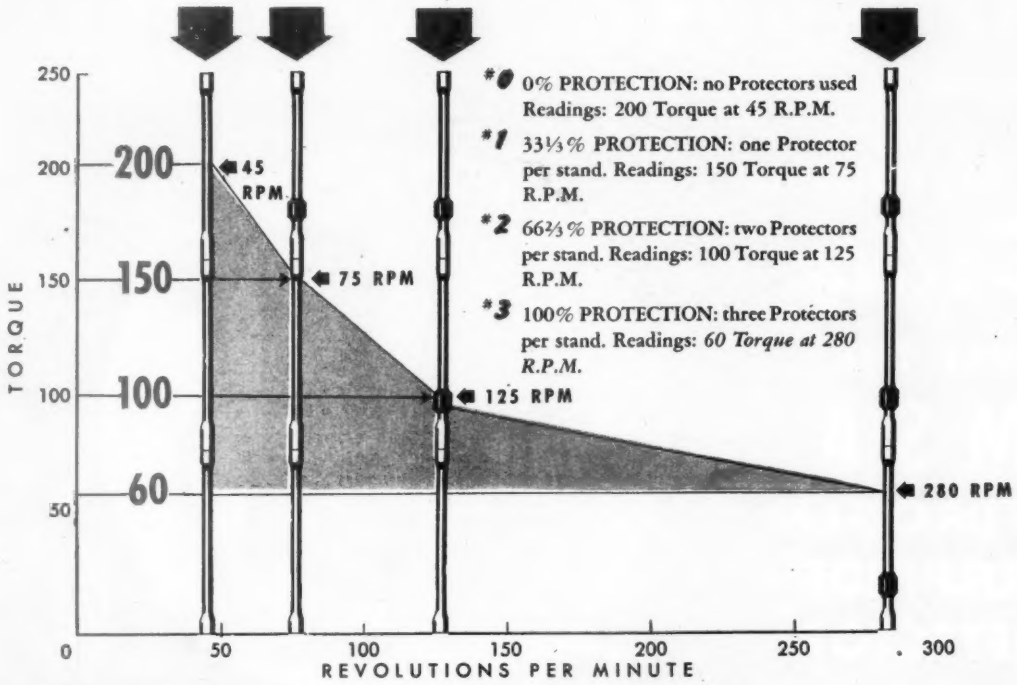
Investigate these money-savers. Write today for Data Sheet 57-2 which describes patented "KOSMOS" Porcelain Plungers in detail. The Aldrich Pump Company, Allentown, Pa.

Representatives: Akron • Birmingham • Bolivar, N.Y. • Boston • Chicago • Cincinnati • Cleveland Denver • Detroit • Duluth • Houston • Jacksonville Los Angeles • New York • Omaha • Pittsburgh Portland, Ore. • St. Louis • San Francisco Seattle • Tulsa.

ALDRICH . . . anticipates industry's pumping needs

CASING PROTECTORS • STABILIZERS • PIPE WIPERS • WIRE LINE GUIDES • WIRE LINE WIPERS • KELLY WIPERS
KELLY SUB PROTECTORS • MUD GUNS • MUD GUN NOZZLES • SWIVEL BAIL BUMPERS • DEAD LINE STABILIZERS
TRAVELING BLOCK BUMPERS • TUBING PROTECTORS • SUCKER ROD WIPERS • TUBING WIPERS

One! Two! Three! and your TORQUE is O-U-T!



CASE HISTORY No. 3
CHOCOLATE BAYOU
(Well number on Request)

Watch Torque drop as you add protectors! Here's proof about friction . . .

This chart is an actual case at Chocolate Bayou on a rig of a large oil operator. The figures are actual Torque and R.P.M. instrument readings. #0—Without Protectors; #1—Drill Pipe ⅓ protected with one Protector per stand; #2—Drill Pipe ⅔ protected with two Protectors per stand; and, #3—DRILL PIPE 100% PROTECTED with *3 Protectors per stand.*

Note that the greatest reduction of Torque due to friction was when the final ⅓ of the Drill Pipe was covered, proof that for full protection, one Protector at each tool joint should be used

6¾ inch O.D. Patterson-Ballagh lip style Casing Protectors were used, installed on 7,000 feet of 4½ inch drill pipe in 9⅝ inch casing. Your tool joint and casing wear is greatly reduced by the use of these money-saving PBX Synthetic Rubber Casing Protectors.

Your nearest Patterson-Ballagh representative will gladly give information as to proper sizes and tell you how to obtain 100% protection NOW.

"Best Bet Yet"

PATTERSON-BALLAGH
LOS ANGELES 1 • HOUSTON 10 • NEW YORK 6

PATTERSON-BALLAGH
DRILL PIPE AND CASING
PROTECTORS
Now Made of PBX Synthetic Rubber . . . Oil and Weather Resistant

THE NOSE DOESN'T KNOW ABOUT HYDROGEN SULPHIDE!

FOR DEPENDABLE *Safety*

USE THE

M·S·A

HYDROGEN SULPHIDE DETECTOR

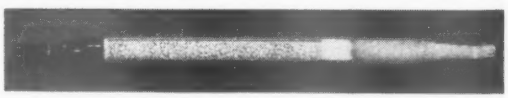
Provides ready detection and measurement of deadly H_2S hazards on the job!

Exposure to Hydrogen Sulphide concentrations in air above .07% can be fatal—smaller amounts can cause serious physical harm. Don't rely on the nose as an indicator (H_2S impairs the sense of smell)—use the M.S.A. Hydrogen Sulphide Detector to measure suspected atmospheres.

The compact M.S.A. Hydrogen Sulphide Detector provides quick, easy, H_2S determination wherever the hazard exists in the petroleum industry. Operation on the job is simple: by means of an aspirator bulb, air samples are drawn through a detector tube in which the amount of discoloration is proportional to the H_2S concentration in the atmosphere under test.

Detector tubes are hermetically sealed—the complete outfit is contained in a sturdy, easy-to-carry leatherette case.

Write for descriptive literature, and a demonstration without obligation.



Glass detector tubes have scored tips which are broken off prior to use. Discoloration of chemical is checked against standard scale to find percentage of H_2S in air; indicates amounts from .0023% to .04% by volume.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS PITTSBURGH 8, PA.

District Representatives in Principal Cities

In Canada: MINE SAFETY APPLIANCES COMPANY OF CANADA, LIMITED

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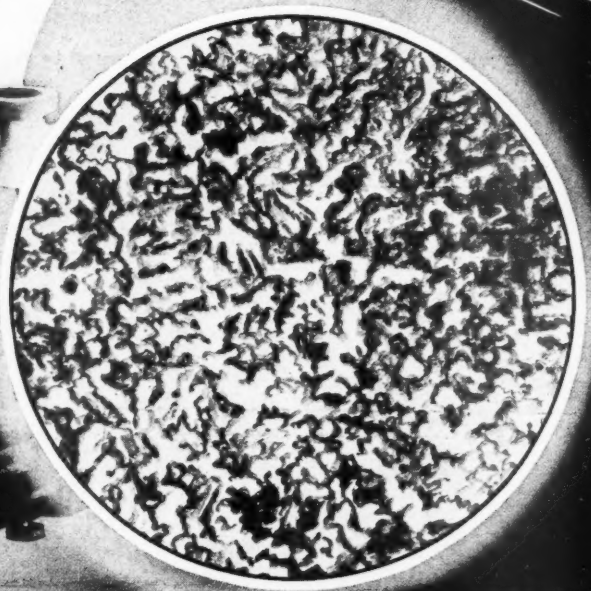
HERE'S

HERE'S MORE THAN THE EYE CAN SEE IN

TESCO *Quality* STEEL



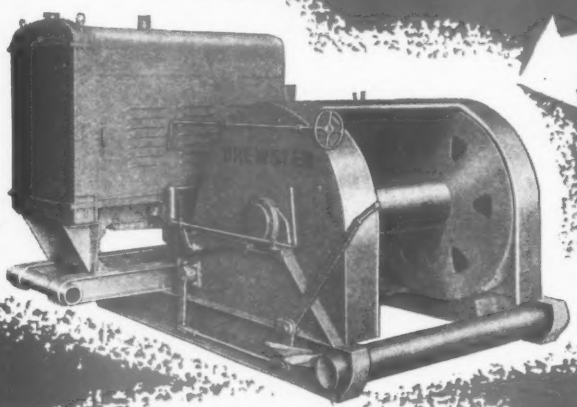
As the Tesco microscope sees your castings! Grain structure of Tesco Quality Steel . . . magnified 100 times . . . is closely watched through the metallurgical microscope.

TEXAS ELECTRIC STEEL CASTING CO.

GOOD CASTINGS TESCO HOUSTON, TEXAS

BREWSTER Equipment Re

Brewster's new Shreveport Plant, where our craftsmen have won their 5th Army-Navy "E" Award for high achievement in the production of war materials. Here Brewster will apply line-production methods in the manufacture of fine oilfield equipment.



COSING REEL. Compact, sturdy and simple in design. Built in four sizes with full-wrap brakes from 6" x 30" to 6" x 48", and powered with 30 H.P. to 145 H.P. motors.

6" ND OILBATH SWIVEL. Designed for 10,000 ft. drilling. Streamlined for safety. Circulating 15 gallons of oil. 3" unrestricted fluid passage. 250 ton capacity. Also available in 200 ton capacity.

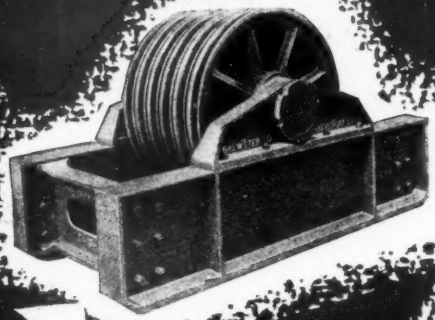
27½" OILBATH ROTARY. One-piece bed-skid gives maximum rigidity. Replaceable shrunk-on table gear. Ball bearing table and roller bearing pinion shaft, oilbath lubricated. 350 ton capacity at 10 r.p.m. Standard 53¼" centerline. Full table opening.

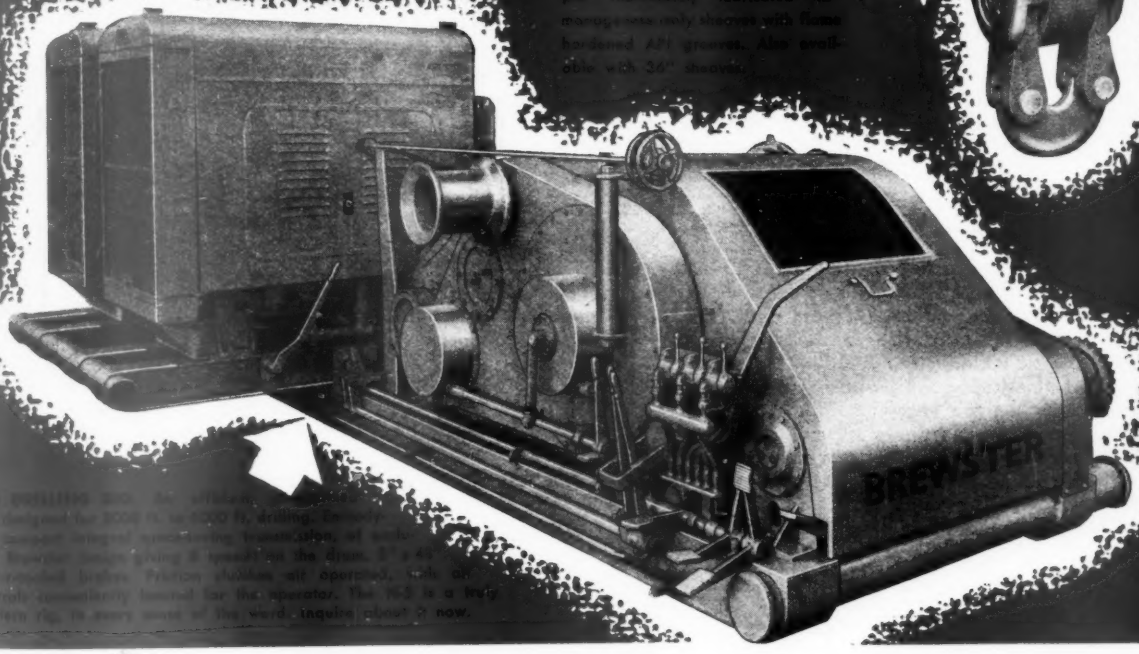
For 34 Years Brewster Has Been Manufacturing Fine Oilfield Equipment

ARMY E NAVY

THE B

Ready for Immediate Delivery!



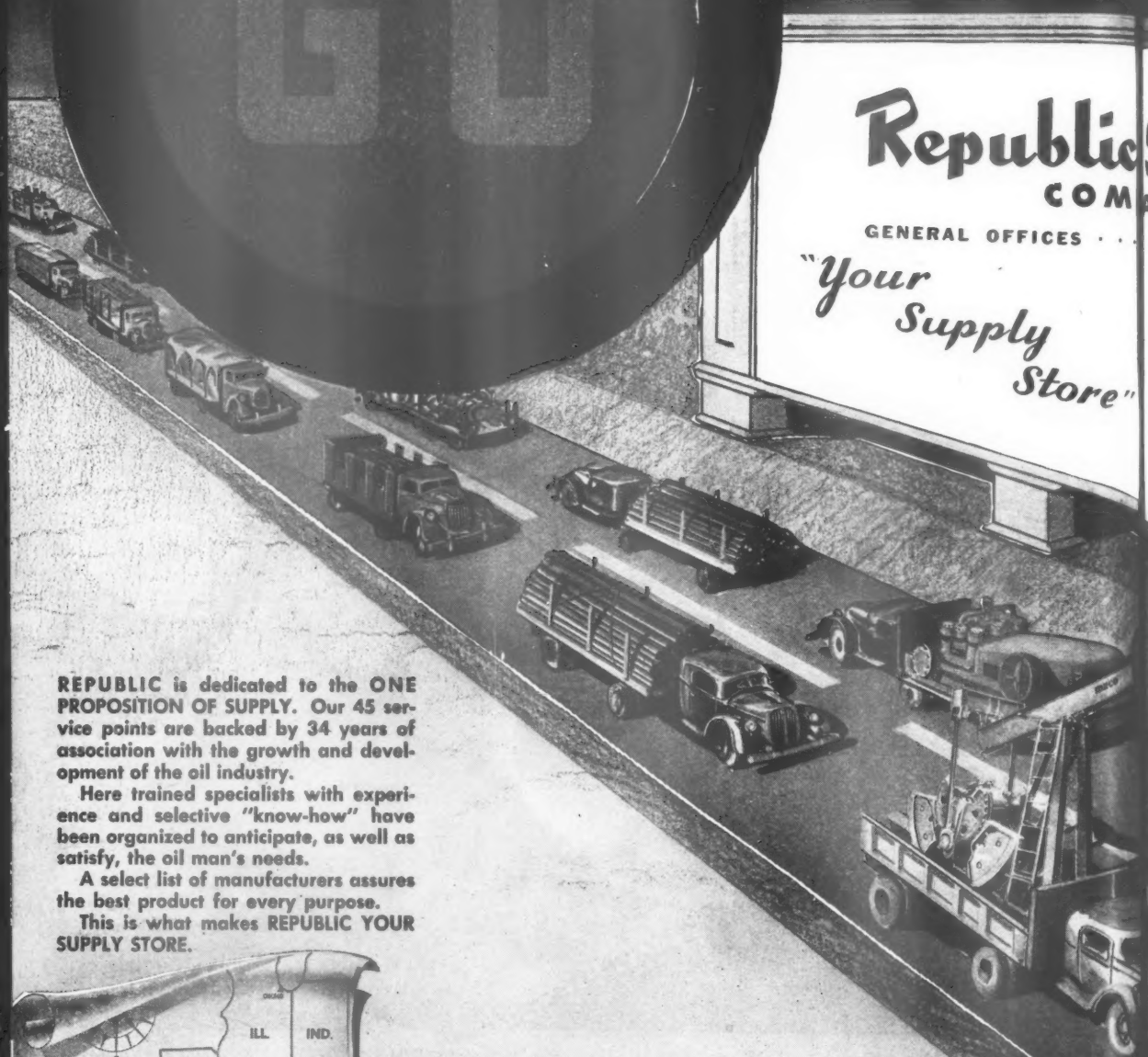


BREWSTER CO. INC.

SHREVEPORT, LOUISIANA

Export Office: Acme Well & Supply Co., 19 Rector Street, New York City

Your Green Light to



REPUBLIC is dedicated to the ONE PROPOSITION OF SUPPLY. Our 45 service points are backed by 34 years of association with the growth and development of the oil industry.

Here trained specialists with experience and selective "know-how" have been organized to anticipate, as well as satisfy, the oil man's needs.

A select list of manufacturers assures the best product for every purpose.

This is what makes REPUBLIC YOUR SUPPLY STORE.

REPUBLIC SALES AND SERVICE POINTS

ARKANSAS—Camden, El Dorado, Patmos; ILLINOIS—Chicago, McLeansboro, Salem; INDIANA—Griffin; KANSAS—Ellinwood, Russell, Wichita**; LOUISIANA—Haynesville, New Iberia, Rodessa, Shreveport*; MISSISSIPPI—Jackson, Natchez***, NEW MEXICO—Hobbs; OKLAHOMA—Oklahoma City, Seminole, Tulsa**; TEXAS—Alice, Big Spring, Borger, Corpus Christi, Dallas**, Electra, Falfurrias, Fort Worth**, Hebbronville, Houston*, Kenedy, Kermit, Kilgore, Nocona, McAllen, Monahans, Odessa*, Olney, Pampa, San Antonio**, Sundown, Talco, Victoria, Wichita Falls***

* District offices and stores.
** Sales Office
*** Pipe Depot

...to Prompt Supplies

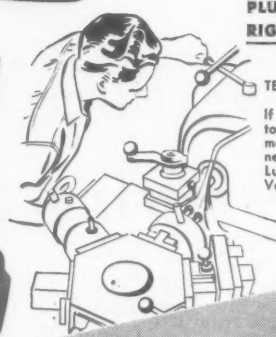
LUNKENHEIMER

TOP PERFORMANCE

COMES FROM SUPERIOR "Know How"

Fig. 2129

THE RESULT OF LONG ACCUMULATED EXPERIENCE PLUS QUALITY STANDARDS RIGIDLY MAINTAINED



HE'S INTERESTED IN TEN THOUSANDTHS OF AN INCH

If parts do not measure up to the stringent requirement for accuracy they never enter a Lunkenheimer Valve.

Fig. 2125

A BIG "PLUS" IN MOLDING —skilled men and modern machinery. This craftsman cleans cores; removes all parting line edges, assuring smooth castings on inside.

For over three quarters of a century, Lunkenheimer has specialized in the manufacture of valves . . . the most efficient and dependable valves which scientific design, engineering knowledge, and fine mechanical skill can produce.

"Quality" is a living ideal at Lunkenheimer—guiding every operation from design to final assembly. Maintenance men well know that quality. Through long experience they've come to rely on Lunkenheimer Valves for the best in performance at lowest maintenance cost.

A Lunkenheimer Distributor is located near you. His complete facilities are at your service.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U. S. A.

NEW YORK 13 CHICAGO 6

BOSTON 10 PHILADELPHIA 7

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

BRONZE, IRON, STEEL, AND CORROSION RESISTANT ALLOY VALVES—125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS.

LUNKENHEIMER VALVES

Timken Seamless Steel Tubes are made from steels which have been developed by The Timken Roller Bearing Company to defy the destructive effects of extreme heat, high pressure, corrosion and oxidation.

This 17 year old study of steels for high temperature service combined with our long experience in melting, rolling and piercing, has resulted in producing tubes of uniformly high quality. Many have been used to combat some of the most difficult problems faced by refiners in all parts of the world.

When you install tubes be sure to specify Timken Seamless Steel Tubes. They will provide maximum life and enable you to properly balance your production costs. We will be glad to help you select a tube of the analysis that will fit the operating conditions encountered in your refinery. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
SEAMLESS STEEL TUBES

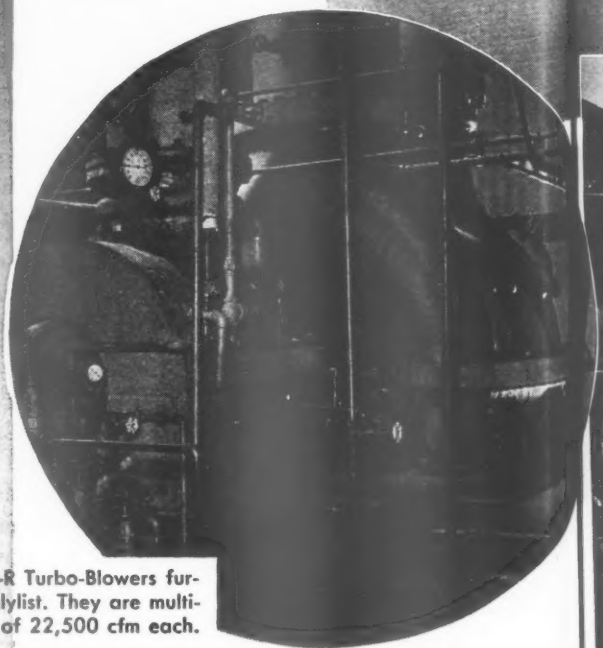
I-R COMPRESSORS TURBO-BLOWERS PUMPS *in* *Baltimore Catalytic Cracking Plant*

These machines are there because they have extra-special ability to stay on the line. Ingersoll-Rand's wide experience in the petroleum, chemical, and process industries provides a background of knowledge that enables I-R engineers to predict in advance what might cause a shut-down of a machine. Then, with unexcelled engineering and manufacturing facilities, they design and build a product that reduces to a minimum the possibilities of a failure or shut-down.

Whenever you have problems of handling liquids and gases under pressures, vacuum, or refrigeration, let Ingersoll-Rand help you.

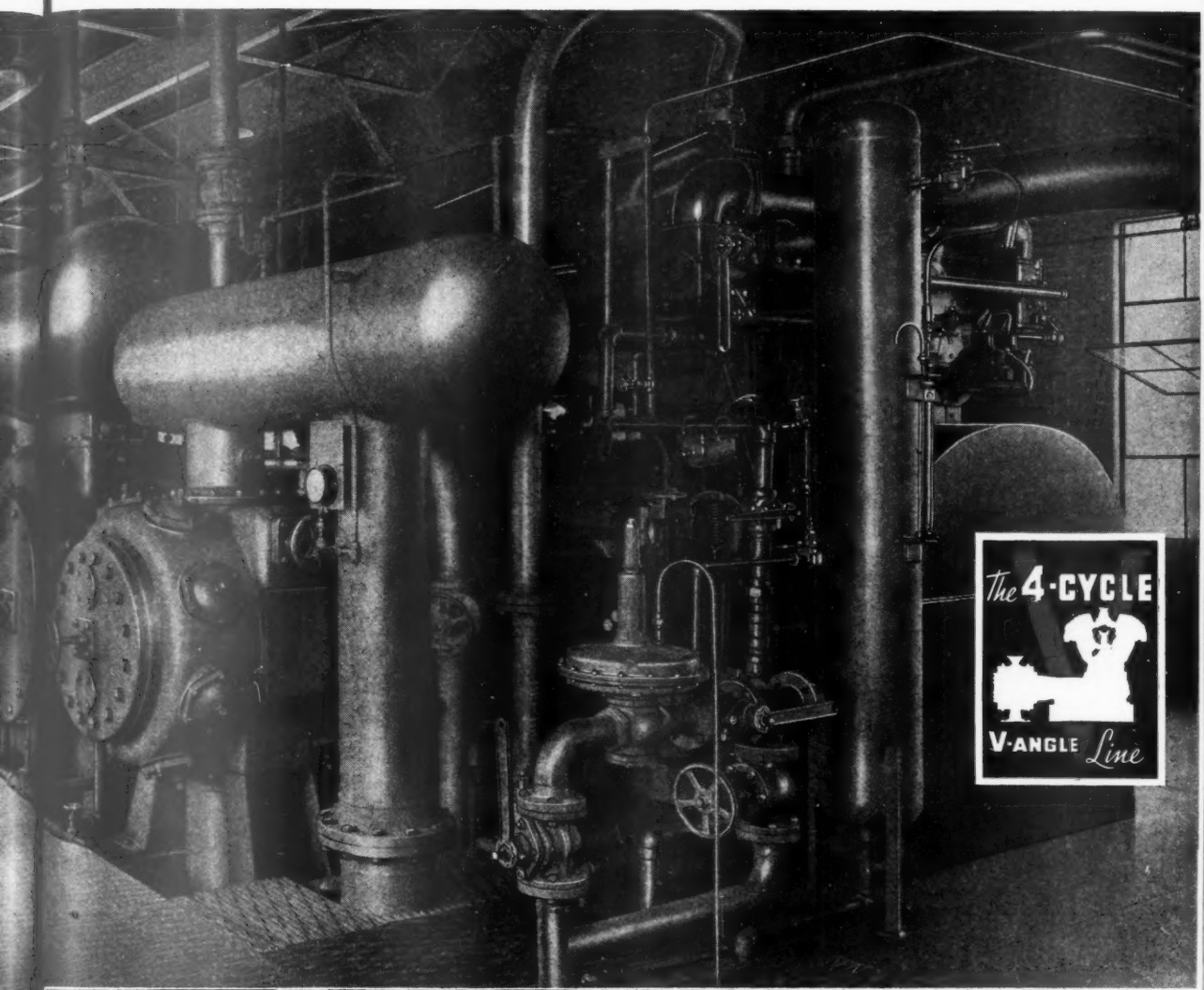
GAS-ENGINE-DRIVEN COMPRESSORS

Five 600-hp, Type KVG 4-cycle gas-engine-driven 2-stage compressors pull light ends from the catalytic-cracking tower and discharge into recovery apparatus. (Similar I-R compressors are available from 75 to 1000 hp.) Ingersoll-Rand 2-stage air-cooled compressors supply starting air for these machines.



TURBO-BLOWERS: Two 1700-hp I-R Turbo-Blowers furnish air at 15 psi for the fluid catalylist. They are multi-stage units with a free-air capacity of 22,500 cfm each.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

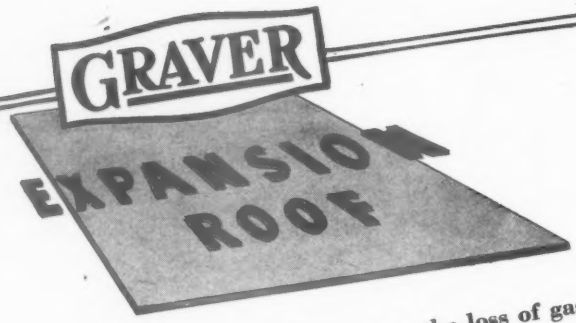


PUMPS: A battery of remote-controlled Ingersoll-Rand Motor-pumps handle gasoline and fuel oils from storage. Other I-R pumps in the refinery include three large 16-inch pumps handling brackish bay water for general service.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

14-791



The Graver Expansion Roof Tank prevents the loss of gasoline vapors by providing a variable vapor space actuated by the expansion and contraction of the vapors.

Furthermore, where several cone roof tanks are spaced reasonably close together, their contents can also be protected against vapor loss by manifolding their vapor spaces to the vapor space of a Graver Expansion Roof Tank of suitable size, resulting in *multiple* savings with but *one installation.*

In this manner refineries and pipelines all over the country are annually saving thousands of gallons of gasoline. To get full details, just write for our bulletin No. C-101, today.

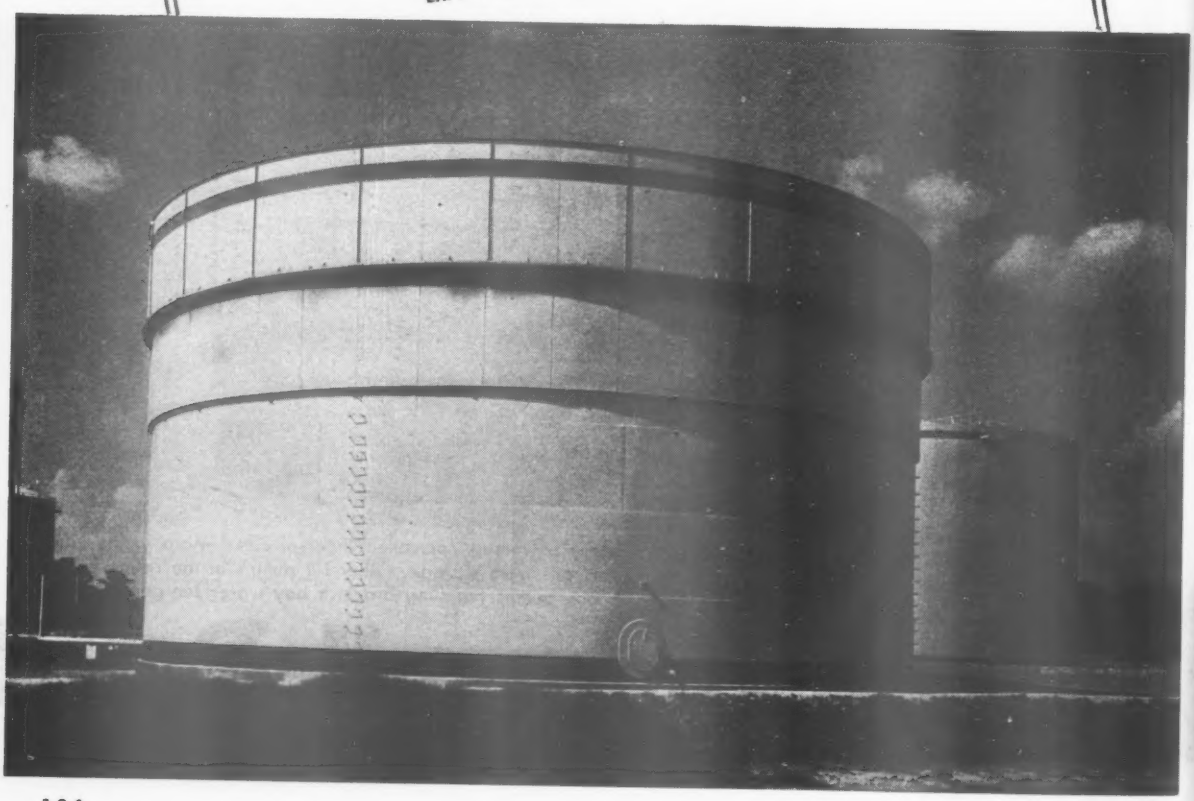
There's a Graver representative as near as your telephone.

Fabricated Steel Plate Division of

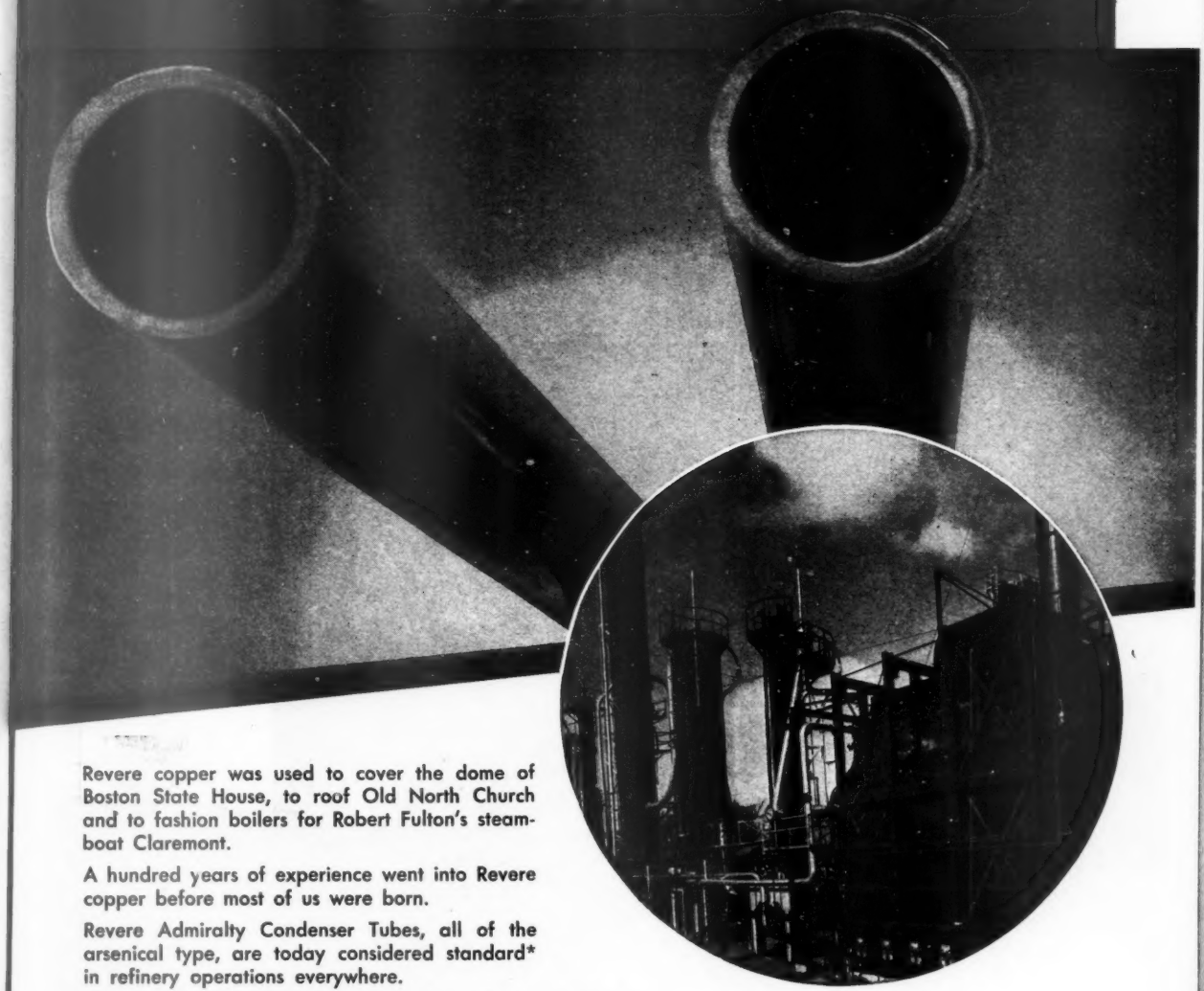
GRAVER TANK & MFG. CO., INC.

General Offices: 4811-13 Tod Ave., East Chicago, Indiana

NEW YORK CHICAGO CATASAUQUA, PA. TULSA, OKLA.
PHILADELPHIA PORT ARTHUR, TEX.
EXPORT DEPT., 424 MADISON AVE., NEW YORK, N. Y.



Why we recommend REVERE Condenser Tubes



Revere copper was used to cover the dome of Boston State House, to roof Old North Church and to fashion boilers for Robert Fulton's steamboat Claremont.

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HOW TO MAKE YOUR GOODALL ROTARY HOSE LAST LONGER

(No. 6 of a Series)

Right: Showing the first stages of the repair job. The operator is buffing off all the old rubber and removing duck and wires. After coupling has been cleaned thoroughly the hose is cut behind the break; all pressure wires are cleaned and coupling is reinstalled. The same equipment and materials are used as when hose is manufactured.

Below: Showing the operator building a Barney Coupling back on Goodall Rotary Hose. Notice the reinforcing wires being applied from the body of the hose over the coupling. This is a protection against improper swivel hook-up.

Below, right: Illustrating the final operation of repair. This photo shows our Special End Vulcanizer curing the hose. The same cure is used in the repair shop as is used when the hose is first manufactured.

COMPLETED REPAIR JOB

Note the streamlined integral construction between Barney Coupling and Goodall Hose — a most important factor in preventing flexing or cutting at this juncture. **This is a typical Goodall End Repair.**

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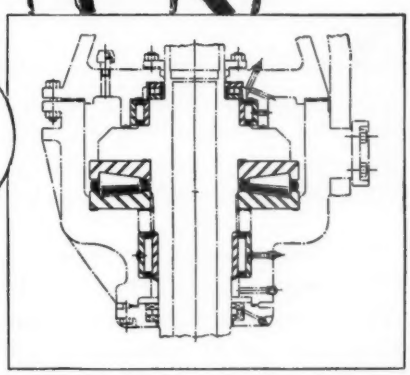

This Torrington conical roller thrust bearing assures smooth, anti-friction operation of the swivel and has a thrust load capacity of well over 300 tons at more than 300 RPM. Weight of swivel is carried on small double-row thrust bearing at top, and two single-row roller bearings handle the radial load.

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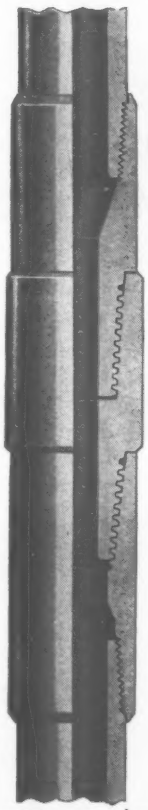

THIS CONVENTIONAL TOOL JOINT WITH WEAR SUB COSTS **25% MORE** THAN THE HYDRIL *OS "TWINPIN"— A COMBINATION DRILL PIPE CONNECTOR AND WEAR SUB.

A.P.I. or Hydril Thread

EVEN WITHOUT A WEAR SUB, THIS TOOL JOINT COSTS 3 TIMES AS MUCH AS THE RE-SHEATHED HYDRIL "TWINPIN"

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Shown on the opposite page is a Sullivan 200-A Motorized Drill Rig in a Texas field. This rig is recommended for deep structure testing or shallow slim-hole production drilling—up to 2,500 ft. Capacity 20,000 lb. drilling string.

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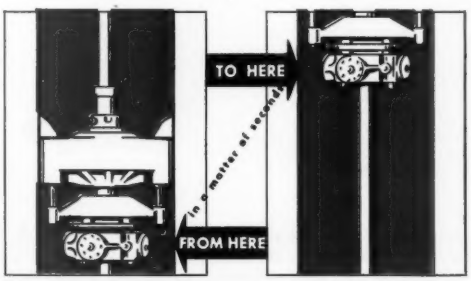

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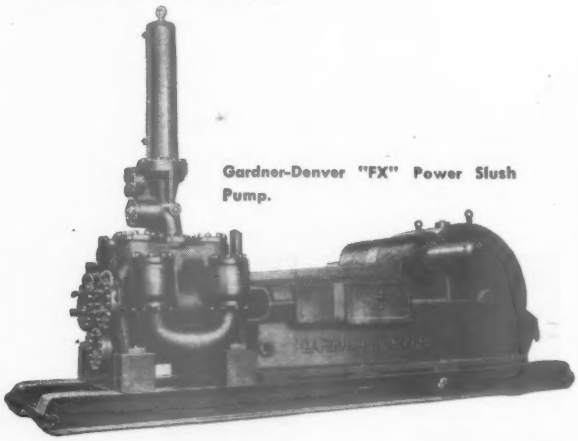
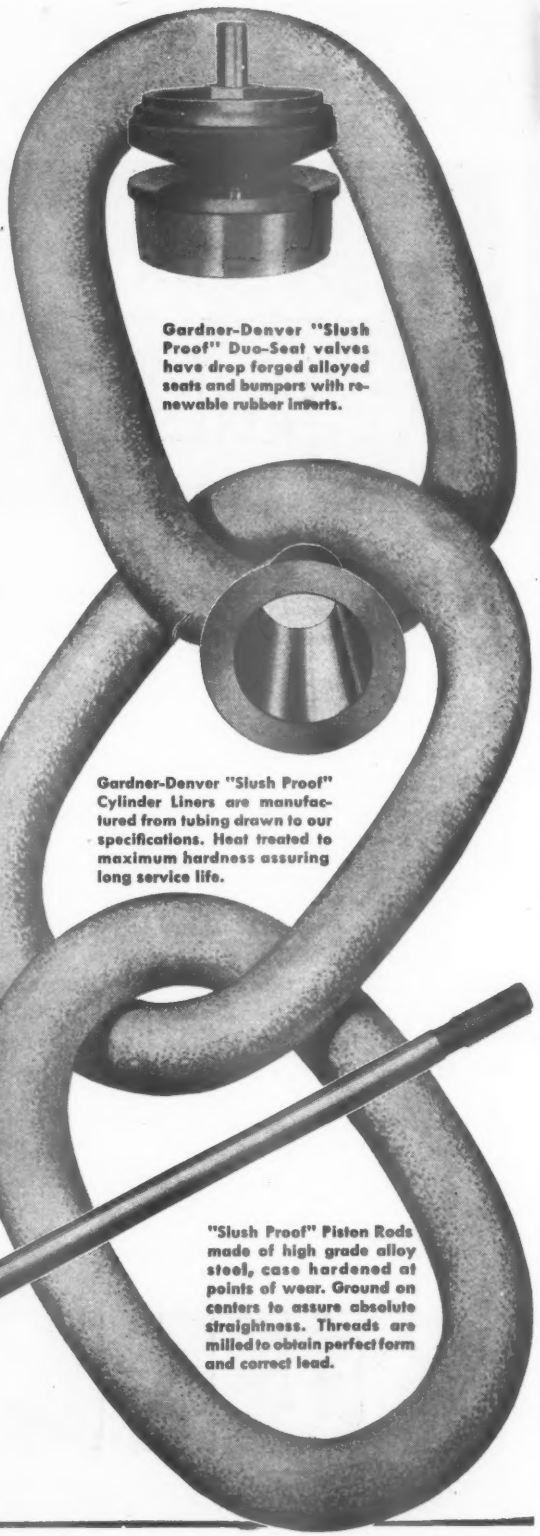


Gardner-Denver "FX" Power Slush Pump.



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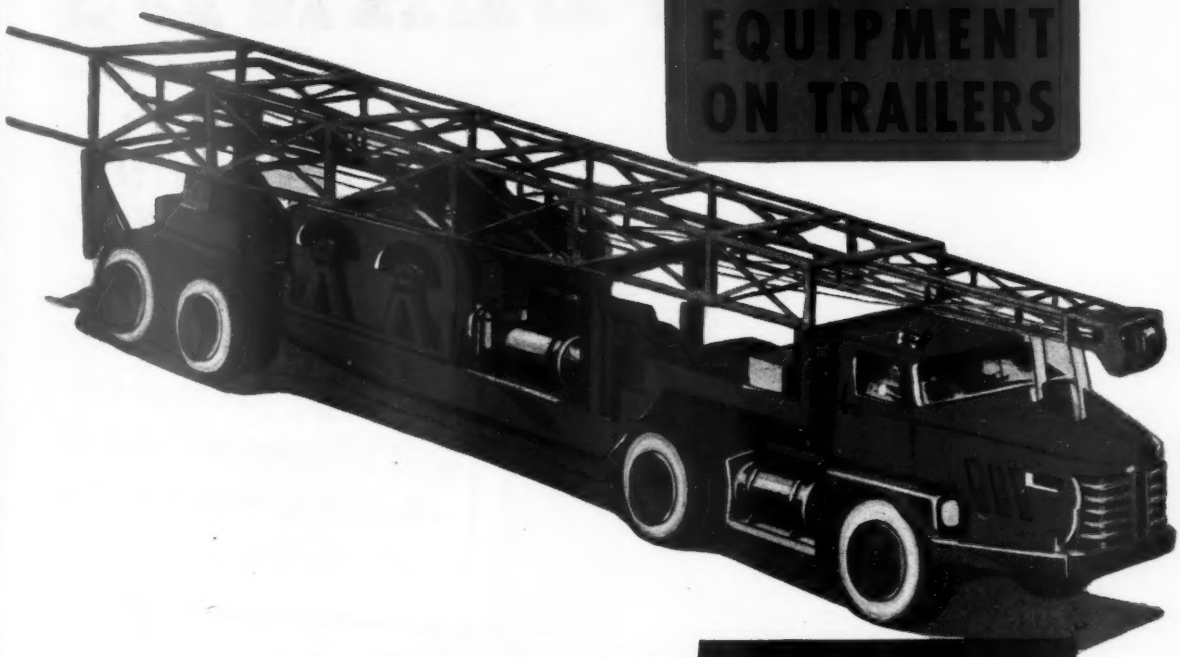

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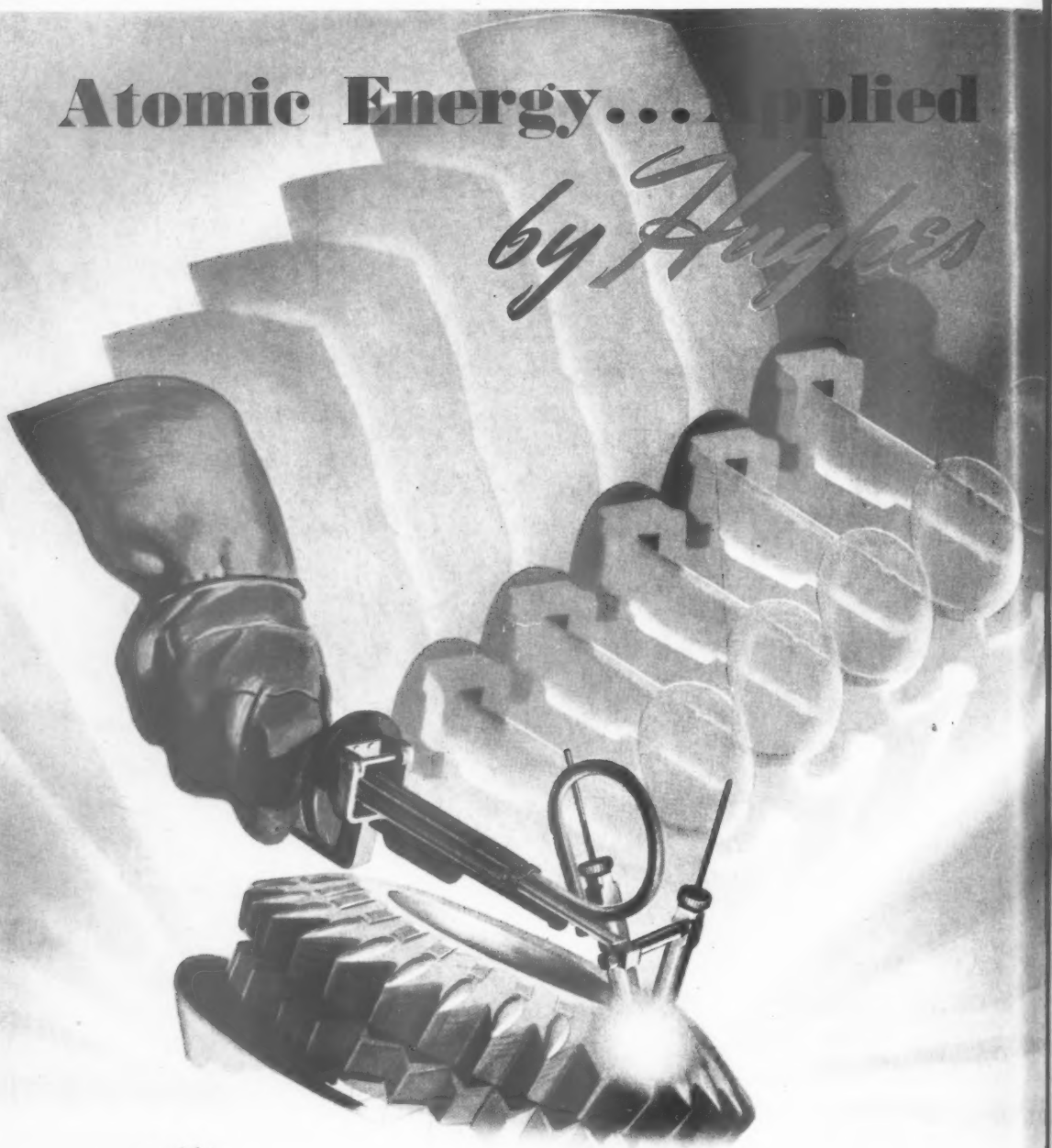

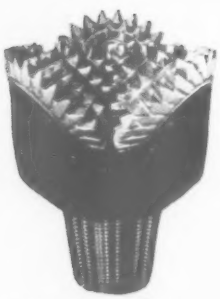

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